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RAILWAY ACCIDENTS.

For some time there has been a conscientious effort upon the part of railways to eliminate the possibility of fatal accidents both to employes and others liable to injury in the ordinary conduct of railway systems. For the perfection of safety devices railway corporations have expended large amounts of money, and the efforts of inventors have been encouraged in order to procure the greatest measure of safety to those coming in contact with the vicissitudes of railway operation. The heavy penalties exacted in case of injury, and the readiness with which the ordinary jury has sought to mulct the transportation company, have been sternly contributory to the attitude of mind which has prompted the safeguarding of human life. Even when the railroad corporation has done all that seems reasonable to protect others from injury there has come about recently a new idea as to what constitutes contributory negligence on the part of one injured. Notwithstanding ordinary safeguards, such as block signals, train annunciators and gated crossings, it has been held in several important suits at issue that the loss of one's life is too great a penalty to pay for ordinary negligence, and that the railroad must see to it that the trespasser be not allowed to suffer by reason of his well-proven negligence.

The compilation of statistics by commissions in several states and by the Interstate Commerce Commission has thrown some actual light on the decreased number of accidents in recent years, and it is a cause for satisfaction to realize that in spite of increased traffic and more rigorous demands upon the railway systems in general, the number of accidents is decreasing. Bulletins of the Interstate Commerce Commission for the year ending June 30 show that during this period there was a total of 3,764 killed and 68,989 injured, a decrease in the total number of 1,236 killed and 3,297 injured, compared with the number reported for the same period a year ago. For the three months ending June 30 the total number of casualties was also lower.

Not only in this country does this condition obtain, but the same is true of the United Kingdom, for which statistics are at present available. According to the Board of Trade report on railway accidents in Great Britain last year, 120 passengers lost their lives on the railways, as against 166 in the preceding year. During 1907, 454 servants of railway companies or contractors lost their lives, and 5,813 were injured, as against 438 killed and 4,365 injured in 1906. While this shows an increase, it is only an apparent increase, owing to the new Board of Trade regulations, which list minor accidents involving only a day's absence from work, which were not reported in previous years.

ELECTRICAL DRIVING IN COTTON MILLS—TWO BRITISH VIEWS.

In a recent issue of the *Electrical Review,* of London, Mr. W. H. Booth takes issue with those engineers who have put forward what he considers extravagant claims as to the desirability of installing motor-drive in cotton mills, and speaks strongly against the adoption of direct-connected motors, and particularly individual driving. Comparing belt-drive with direct connection, Mr. Booth says that while it may be possible to start a frame more quickly than is done with a belt, it will perhaps be sufficient to say that the frame may be brought to full speed by belt quicker than it now is started, because the women "tenters" are paid on the piece system, and are aware that they may lose more by starting too quickly than by starting at a gentle acceleration. This seems to be a point which can hardly be considered a disadvantage in electrical driving. With properly constructed starters and with motors of the interpolar type, not only a gentle, but a very even, acceleration can be secured; and although it must be admitted that the cotton-spinning machines generally run continuously and at a constant speed, it is an advantage to have a driving device that will allow the speed to be changed, and will also permit the machine to run efficiently if more than one speed is desirable.

Mr. Booth claims that usually, when driving a ring frame by its own electric motor, it is necessary to make room for the motor by decreasing the length of the frame by several spindles. It is said that the greater output of yarn per spindle in a recent case investigated was more than counterbalanced by the reduced number of spindles. The better appearance, the advantage of the absence of belts, and the improved lighting facilities, are admitted. Even though the spindle output be increased, say, five per cent, he believes it is not worth while doing so if this entails an expenditure of seven per cent of the spindles cut away to make room for the separate motor.

In the same issue of our London contemporary there is an illustrated description of the electrical equipment in an English cotton mill. The identity of this installation is not revealed, but the following paragraph is of interest, remembering the criticisms made by Mr. Booth, and referred to above:

"Fortunately, circumstances do arise occasionally when a really modern electrical drive appeals to the mill-owner, a case in point being a recently-built doubling shed erected by a well-known firm of fine cotton spinners and doublers. In this case electrical driving was only decided on after exhaustive tests had been carried out."

The illustrations show the spinners and doublers equipped with enclosed motors, with the switch gear attached to the ends of the frames. The absence of belting allows a fine wiring scheme to be carried out, and makes possible very good daylight and artificial illumination.

The shed contains fifty doubling frames and the necessary auxiliary machinery, each frame being driven by a twelve-horsepower motor. The textile operations dealt with necessitate a wide range of speed, and variable-speed, ball-bearing motors of the interpolar type have been installed. Speed variation is of special importance in this class of work, and the speed of any frame may be carried to the highest limit, according to the particular work being dealt with at the time.

It may be well to mention, in passing, that experience has already shown that the cost of running is so low that the proprietors are installing some thousands of additional spindles, to be driven from another 150-kilowatt generating set.

WIRELESS TELEPHONES FOR THE GOVERNMENT.

It is understood that the United States Navy Department is about to ask for bids for powerful wireless telephone apparatus, the specifications calling for devices capable of establishing reliable communication for distances of not less than 100 miles. It is intended to supersede, as far as practicable, the wireless telegraph, and make communication by wireless telephone as complete as possible between certain to-be-established points of rendezvous.

The great amount of attention which has been paid by the Government to the development of wireless telegraph and wireless telephone apparatus is in marked contrast to its attitude when Morse was looking for governmental help to run his Washington-Baltimore line fifty years ago. At that time meager appropriations were squeezed out by painful efforts and great persistence on the part of this hardy inventor. Today not only is the Government making goodly appropriations for the development of wireless telephone and telegraph apparatus by private individuals, but the engineering corps is bending its best efforts to the improvement of the material turned over by private investigators. Some of the best work in wireless development has been done by the Government engineers, and to them is due the credit for establishing all of our most recent records for both distance and quality of service.

The success of the initial equipment of de Forest wireless telephone instruments on board United States men-of-war has helped materially to establish the advantages of the wireless telephone as a means of ready communication between ships at sea and between ships and nearby shore stations. There seems to be no reason why greater ranges of distance cannot be covered by improved apparatus, and a number of investigators have apparently pointed out the way in which this can be readily accomplished. Indeed, it seems that with the remodeling of present-day apparatus, particularly in reconstructing the telephone transmitter to work reliably at higher potentials, and to withstand the heating effects introduced by the high-frequency oscillations superimposed upon the natural vibrations of the transmitter diaphragm, a great step in advance will be taken, and we are promised that this consummation is near at hand. It is unfortunate that at present the field of wireless telephony is more or less clouded by litigation and the rival claims of several bona-fide and conscientious investigators. This, however, will hardly retard the progress of development, and the attitude of the Government, whether it work to the benefit of the individual investigator or not, will hasten the day when at least near-perfection shall be attained.

DEPRECIATION AND REPAIRS.

Depreciation amounted to 4.09 per cent, and repairs to 6.06 per cent annually, during sixteen and one-half years, on an average, according to the statement of one electric-lighting company.

This statement was made several years ago, at a public hearing on the question of further stock issues, as bearing on the value of the electric plant, and was not controverted.

It is not the purpose here to either indorse or criticize the accounts of this company, and no investigation has been made that would warrant either course, but the figures are given for what they are worth. While they may be entirely correct for the electric plant in question, it is of course very uncertain how far they would apply in any other case.

At the time that the statement of its repair and depreciation accounts was made, the electric company had a steam-driven generating plant of about 1,100 kilowatts capacity, made up of both direct and alternating-current apparatus. During the period of sixteen and one-half years to which the repair and depreciation accounts apply, the electric plant had gradually grown from a capacity of about 200 kilowatts.

Taking the entire series of years, the average investment of the company was put at $168,895, in each year, while the total depreciation was given as $114,011, and the entire amount expended for repairs was $138,741. With these amounts as a basis, the average annual depreciation of the plant was put at $6,909, and the average amount annually expended for repairs was $8,408. From these figures came the above conclusion of 4.09 per cent on investment for annual depreciation, and 6.06 per cent for repairs.

Perhaps the most interesting part of the accounts, as stated, was the separate items of repairs, which were as follows: Repairs, steam plant, $42,408.11; repairs, electric plant, $18,-152.81; repairs, lines and transformers, $70,413.09; repairs, station building, $7,767.17; total repairs, sixteen and one-half years, $138,741.18.

As was to be expected, the items for steam-plant repairs and for line and transformer repairs are large, and the size of the steam-plant item brings out in a striking way the great change that has taken place in motive-power equipment since electric stations were started some twenty years ago with simple non-condensing engines, often in sizes as small as 100 horse-power.

Stated in percentages, the steam plant absorbed 30.5, the electric plant thirteen, lines and transformers 50.7, and the station buildings 5.6 per cent of the repair charges.

At the middle of the period of sixteen and one-half years covered by the depreciation and repair accounts, the generating capacity of the electric station amounted to very nearly 800 kilowatts, and if this be taken to be the average capacity for the period, the average annnual depreciation appears to have been $8.63 per kilowatt of generators, for the entire plant.

On a like basis, the total average repairs amount to $9.26 yearly, per kilowatt of generator capacity, for the entire electric system.

THE WESTINGHOUSE PLAN.

The modified reorganization plan of the Readjustment Committee of the Westinghouse Electric and Manufacturing Company, which has been under consideration for several months, has been declared operative, and apparently all that remains before the discharge of the receivers is the carrying out of the formalities connected with the issuing of the new stock provided for, and, of course, other details which, now that the fundamentals are ready for promulgation and inauguration, will be incidental to the course of reconstruction. By the end of this week the stockholders will have met in Pittsburg to elect new directors and ratify the various measures necessary to the completion of the reorganization plan. Undoubtedly, the merchandise creditors and the bankers who have been co-operating for the purpose of reorganization will have a powerful voice in the affairs of the company, and with this end in view the directorate will be increased from twelve to sixteen, divided into four classes, serving from one to four years each.

Four factors have combined to win success for the reorganization plan, and this success has been won against great odds. These factors have been the loyalty of stockholders in subscribing for $6,000,000 worth of stock at par when it was selling at hardly half that price in the open market; the liberal co-operation of merchandise creditors in agreeing to take $4,000,000 of stock at par in settlement of that amount of claims held against the company; the participation of bankers holding $7,900,000 short-time notes of the company in coming to the front with eighty-five per cent of the total amount and taking securities in payment of their obligations. To these factors must be added that which has been most important and inspiring: the personal enthusiasm and optimism of George Westinghouse, president of the company.

THE CHICAGO ELECTRICAL SHOW.

The fourth annual Chicago Electrical Show will be held under the auspices of the Electrical Trades Exposition Company at the Coliseum, Chicago, from January 16 to January 30. Present indications point to even greater success than has attended the efforts of those responsible for the show on the three former occasions, when expositions of record-breaking proportions, both in number of attendants and general interest, were conducted. Last year, although in the midst of a financial disturbance of considerable magnitude, stockholders and exhibitors alike were well satisfied with the money put into this enterprise. This year eighty per cent of the exhibit space has now been spoken for, and it is expected that by the middle of December all the available allotments will have been taken up.

The same excellent decorative features, with a possible enhancement of lighting effects, will obtain at the coming show, and it is purposed to increase the number of working demonstrations and render the exposition, if possible, more attractive than ever to the general public, at the same time making it particularly and significantly an electrical exhibition for the benefit of the electrical industry.

PUBLIC SERVICE CASES.

BY ALTON D. ADAMS, LL.B.

LEGAL RATES—DEPRECIATION AS EXPENSE.

A California statute authorizes county supervisors to fix the maximum rates at which water is sold for irrigation and other purposes, so that the net income upon the value of the property used in furnishing water will be not less than six nor more than eighteen per cent annually. Before fixing the rates the supervisors are required to estimate the value of the property used in furnishing water and the reasonable expenses of operation, including repairs of the water system.

The system of an irrigation company supplies water in the counties of Fresno, Merced and Stanislaus, California, and the supervisors of these counties have fixed the maximum rates for irrigation at eighty-five cents per acre per annum in Fresno County, $1.65 per acre per annum in Merced County, and $1.50 per acre per annum in Stanislaus County. Head works of the irrigation canal are in Fresno County, and after passing through Fresno County the canal runs through Merced County and thence into Stanislaus County. This location of the irrigation system is supposed to be the reason for the higher rate fixed for Merced County than for Fresno County, because of the greater expense of delivering water in Merced County, and the same reasoning would lead to a still higher rate in Stanislaus County instead of the lower rate of $1.50.

The irrigation company asks the court for an injunction to prevent the enforcement of the rates fixed in the three counties, on the ground that these rates will not provide net earnings of at least six per cent on the value of the irrigation system, as provided by statute, and also on the ground that the enforcement of these rates will take its property without due process of law.

According to the estimates of the supervisors of the three counties named the total value of the irrigation system in these counties is $1,201,706.32, and the reasonable annual expense of operating the system is $93,750. On the basis of the number of acres actually irrigated in the three counties, and at the rates fixed by the supervisors, the gross earnings of the irrigation system would amount to $137,873.65 per annum, so that the net earnings would be $44,123.65, or 3.67 per cent on the value of the property as estimated by the supervisors. According to the estimate of an engineer, the value of the physical property in the irrigation system is $1,166,904.53, and the books of the company show an operating expense of $86,437.50 during 1906, giving net earnings of $51,436.15, or 4.4 per cent on this physical valuation, with gross earnings at $137,873.65.

This net earning of 4.4 per cent on the value of the physical property is obviously less than the six per cent provided by statute, and the court said:

"Disregarding the provision of the statute, there is no evidence before the court that an income of 4.4 per cent per annum for this kind of property is reasonable and just."

Besides the physical value of the irrigation system there was the right to divert 760 cubic feet of water per second from the San Joaquin River, which was estimated by the company to have a value of $760,000, but the value of this right was not considered by the court in reaching its decision, but was reserved for future consideration. This right to divert water is in the nature of a franchise, and as to it the court said:

"While this right is undoubtedly of value, it may not be a value upon which ultimately complainant may be given a return under the law."

The estimate of the supervisors as to the value of the irrigation system was based on the present prices of materials, less physical depreciation, and as to this the court said:

"If a deduction is to be made from the value of the plant on this account, then an allowance should be made for such deduction and added to the annual income to enable the complainant to renew and reconstruct, so as to preserve the integrity of the plant."

A temporary injunction was granted pending the final hearing against enforcement of the rates fixed by the supervisors.

San Joaquin and Kings River Canal and Irrigation Company versus Stanislaus County, 163 Federal Reporter 567, United States Circuit Court.

The Waterpowers of Sweden, Norway and Switzerland.

An address was delivered recently by Eduard Engelmann, Austrian state railway superintendent. In view of the intended erection of electric power stations by the Government for the operation of railways in the Austrian Alps, the modern waterpower installations and electric traction systems in Scandinavia and Switzerland were examined by the author. The Brennan mono-rail system was also investigated. The extraordinary advances in turbine construction have been accompanied by the exploitation of waterpowers in Sweden and Norway on a large scale, and a mighty movement is afoot there to adapt the antiquated water laws to the new conditions. The Government is aiding the development in every possible manner and has for itself secured sufficient waterpower to operate the most important railways. According to recent investigations the total waterpowers of Sweden are estimated at ten million horsepower, those of Norway at twenty-eight million horsepower, and those of Finland at four million horsepower. About ten million horsepower could be utilized in the near future. It may be stated that the waterpowers of France and Italy are estimated at three to four million horsepower in each country, and those of Switzerland at one million horsepower, and in none of these countries are the conditions for regulating the water courses so favorable as in Scandinavia, where over four million horsepower are available without regulation. At present there are in operation or under construction plants of a capacity of 500,000 horsepower in the three countries named. It is estimated that by the exploitation of some further million horsepower the imports of coal, iron, fertilizers and other commodities will be so greatly reduced that the present condition will be reversed and the exports will exceed the imports by some twenty million kroner. The cost of the electric generating stations without transmission lines is estimated to be from 250 to 300 kroner per electric horsepower in the south of Sweden and 150 to 300 in the North and 140 to 200 kroner in Norway.

Independent Telephone Convention.

The annual convention of the International Independent Telephone Association will be held at the Auditorium Hotel, Chicago, on December 1, 2 and 3. Sessions will be held in the morning and afternoon of each day for reading and discussion of practical papers. The banquet will be held on Wednesday evening. The manufacturers of telephone supplies and kindred apparatus are co-operating with the association, and a number of comprehensive exhibits will be placed in various rooms, adjacent to convention headquarters.

CONDENSERS.

BY S. K. PATTERSON.

The general use of condensing engines has led to the development of a branch of engineering connected with the construction and operation of condensers, and the knowledge in this field is nowhere near as general and complete as it should be, considering the importance of the subject. Thus condensers consist of a number of different types with different theoretical and mechanical efficiencies and different costs of installations. Some types are only used in special service and others are especially fitted for special types of engines. The various difficulties that are encountered in the operation of a condenser and the maintenance of the vacuum have been more or less satisfacfactorily met in a number of ways, but each of these possesses disadvantages, and in the selection of an average condensing installation the various advantages and disadvantages of each type must be considered and a selection made with this knowledge.

Thus condensers at the present time can be divided into two general classes, jet and surface condensers. Again they can be divided, with equal propriety, according to the maintenance of the vacuum by natural or mechanical means. A number of other divisions exist, but these are of minor importance, as will become apparent in the further development of the subject.

The general theory of condensers is well known. By the maintenance of a vacuum at the exhaust port of the steam-engine cylinder and the condensation of the steam at this point with a rapidity equal or superior to that of its entrance, the advantage of an additional pressure equal to the normal air pressure is obtainable on the piston of the steam engine. The great variability of efficiency of the modern turbine with that of the connected condenser is a fact well-known, and the importance of high vacuum and satisfactory condensation in this field cannot be overestimated. The increase in efficiency due to diminution in steam consumption, for the production of a given amount of power or due, on the other hand, to increased power from a given installation, ranges from fifteen to, in some cases, nearly forty per cent, depending upon the nature of the unit and the efficiency of the condensing device. That condensing machinery has reached its maximum efficiency is a conclusion that can scarcely be made but undoubtedly great steps in advance have been made, as is at once apparent from a study of their relative efficiencies, increased simplicity of construction and of their operative features, many of which only become apparent as the result of continuous operation of the condenser itself under all conditions of load and water variability.

Now, in order to get a clear realization of some of the difficulties actually met with in operation and design of condensers a few details not ordinarily considered may be casually mentioned. In order to produce condensation cold water must be circulated through the vacuum into which the steam comes, and the air carried in by this and by the steam must be removed for the maintenance of the vacuum. The circulating water system must be accomplished through a closed water seal against the atmospheric pressure and this water undergoes, during circuit, comparatively wide variations in regard to pressure and temperature. Heated by the steam in the presence of the high vacuum, where the boiling point of the water is extremely low, the temperature of the water may rise to a sufficient extent to produce spontaneous boiling. Under these circumstances the operation of the condenser for condensing purposes and the increased development of power practically ceases. Again, the air must be removed for the maintenance of the vacuum, which must be held comparatively high, and this can be accomplished most efficiently by the use of vacuum pumps. If boiling occurs the rubber gaskets or packing in the vacuum pump are apt to be burnt out, and flooding with steam or water is an occurrence under many conditions, with resulting deterioration to many of the parts and inconvenience and delay in restarting the condensing feature. Again, many large steam units are so installed today that they do not possess sufficient power if they do not maintain the condensing feature in conjunction with their operation. Thus the temporary withdrawal of the condenser from active service, due to any of these causes, often results in actual shutdown of the plant itself. This feature was formerly more or less present in such installations as rolling mills, etc., where the load was excessive and the duty on the condenser variable and often excessive.

Now, a few words in regard to the constructive details of the various types. The vacuum chamber in connection with the exhaust port of the steam engine is maintained in contact with atmospheric pressure by the use of two columns of water approximately thirty feet high, in actual operation. These columns are identical in theory and operation to the ordinary mercury barometer, and a water circulation is produced merely by pumping the water in one column over the intervening height, whereupon its withdrawal in the other column by gravity is effected automatically. The position of the pump in this device is a very variable factor. It may be used directly to lift the water into the condenser and the outflow accomplished by means of gravity as mentioned. It may be used, on the other hand, to force the water down and out in one of the columns, thus balancing the air pressure directly by mechanical means. The height of the water column under these circumstances is much reduced, and its necessity in others often completely eliminated. Again, this thirty-foot vertical height condenser column may occupy various positions with respect to the surface of the earth and the available water supply. If sunken the pump may be used to remove the water from the hot well, with the maintenance of a fixed level at this point and the consequent automatic flow of water through the condenser to supply the deficit. By the use of a pump injecting water into the vacuum the velocity of this water can be used to assist the force of gravity in its removal, and in many of the jet-condenser types this velocity of the water entering into the vacuum, and produced by mechanical or natural means, is often used to assist in the evacuation of both the water and air from the condenser chamber.

This variability of design and mechanism to produce identical conditions has resulted in a considerable variation in size and design of the average condenser. The jet condenser in which water is injected through a fine spray, and then carried off by means of a positive pressure or rotary pump, is the simplest in design and comparatively small in construction. It can be readily attached to the steam engine in any position, but possesses various limitations on efficiency due to the low vacuum maintained with the small ejection of the air by this means. It can exist in very small units in this type, and even in the large ones its size appears very small in comparison to the types using thirty-foot vertical water columns for the maintenance of the vacuum and the operation of an air pump

for the removal of the air. The types using the air pump and the water column, while probably not so common in small installations, possess undoubtedly an increased efficiency over the other type and exist in some cases in comparatively enormous units, single condensers for the condensation of the steam from units as high as 24,000 horsepower being not uncommon.

These various types of condensers are used in various situations and under various conditions of special advantage for each type. Thus, the barometric condenser or condenser using a large water column for a seal against the atmospheric pressure is practically impossible of utilization on shipboard. Some type of the jet condenser utilizing either a simple spray with the velocity of the water itself for the removal of the air or possessing, further, an injector addition for the further removal and entanglement of the air in the outgoing stream is common here. In large stationary plants, where the space is available, the other type is undoubtedly more efficient and satisfactory.

When the water supply is limited, various types of condensers, run in conjunction with cooling towers, which may or may not be an actual part of the mechanism, often possess special advantages. In these the water after being heated by the steam is in turn cooled by evaporation into the air in the cooling tower. The loss by evaporation is less than the supply due to steam condensation, since the latent heats of evaporation and condensation in the two cases are about identical and the water is cooled in addition by conduction to the air. Hence, in this type a slight addition of water is continually made from the steam, which more than counterbalances the loss to the condenser water in the cooling tower, so that no water supply is necessary here. With impure or saline water the surface condenser is necessary. The boiler water must be maintained pure and the water resulting from steam condensation kept separate from the condenser water. This is accomplished by the use of a device equivalent to the ordinary tubular boiler or shell cooler such as is used in refrigeration. The vacuum is maintained on one side of the tubes and the cold water circulated on the other. If this water of condensation is pumped directly through the reheater to the boiler, no necessity for a water seal against atmospheric pressure is necessary in this part of the mechanism. The circulation of the cold water in the other half of the condenser is not limited in operation by the maintenance of a vacuum and much higher temperatures can be acquired by this water without affecting seriously the operation of the condenser. Thus the closed or surface type of condenser possesses many advantages in regard to economy of water consumption, since a given quantity of the water may be made much hotter. However, the rapidity of heat transfer in this type is nowhere near as great as in the jet or barometric condenser, and much larger surfaces must be used to perform the same duty in steam condensation. A given condenser, if of the surface type, possesses less ability to take care of a steam overload but is practically the only type available when limitations are in force on account of water impurity.

A number of additional features of interest to engineers, and not commonly considered, enter in the operation or maintenance of a condenser. A centrifugal pump is often extremely unsatisfactory in the production of water circulation in a condenser of the barometric type. The output of such a pump varies greatly with the air pressure and its action in this regard proves a great disadvantage. When additional steam enters the condenser chamber the water supply falls off instead of increasing with this type. Extreme heating of the water may result, with consequent boiling and a breaking of the vacuum. A positive pressure pump of either a rotary or reciprocal type is much superior. A periodic steam overload, again, may often result in a periodic surging of the water column up and down with ultimate breaking of this and the destruction of the vacuum, and suitable valves must be installed for the prevention of this. In the Weiss type of barometric condenser boiling of the water is prevented by an ingenious device. When the vacuum falls, due to an overload of steam which may cause excessive heating, or when boiling of the circulating water occurs, an automatic valve allows a small quantity of air to enter the vacuum chamber. This lowers the vacuum, raises the boiling point, and stops the boiling of the condenser water. The vacuum is gradually strengthened by the operation of the vacuum pump, and the condenser goes on without stoppage and only a slight diminution in efficiency with this occurrence. With many of the other types boiling of the water results in absolute shut-down. The Alberger condenser possesses two distinct advantages, in turn, over its competitor. The spray valve is maintained in position by a spring which automatically accommodates itself to the quantity of water entering the condenser head. No attention need be paid to the regulation of this valve, as exists in other types, and the water supply is regulated only by the speed of the pump. Its other advantage consists in the very complete and satisfactory device for the separation of the air and moisture in the chamber immediately above the spray cone. Much drier air is furnished the vacuum pump by this device than can be obtained by the other types. Consequently the efficiency in the operation of the vacuum pump is much increased in this development. The steam and water entering in the same direction, assist each other's flow in the downspout. When a counter-current action is attempted with these two ingredients a more complete transfer of heat for a given quantity of water is apt to occur, but steam overloads tend to diminish the water supply on account of the variation in velocity and pressure. Water enters a vacuum under normal air pressure with a velocity of forty-seven feet per second, and steam enters the same vacuum, under normal conditions of operation, at a speed of about 1,900 feet a second. This high velocity, and its utilization in the maintenance of water flow through the condenser, is undoubtedly partially responsible for the great efficiency of this type of condensing apparatus. Practically all makers of the barometric type of condensers make jet condensers, using a pump directly as well. The field is so divided that all types of condensers serve a distinct and separate purpose in special fields in which other types cannot compete with any degree of satisfaction. The necessity of having large pipes with rapid flow and a high capacity in turbine condensers is well known, and the result is that specialization in this field is going on with considerable rapidity, and new developments are of almost daily occurrence.

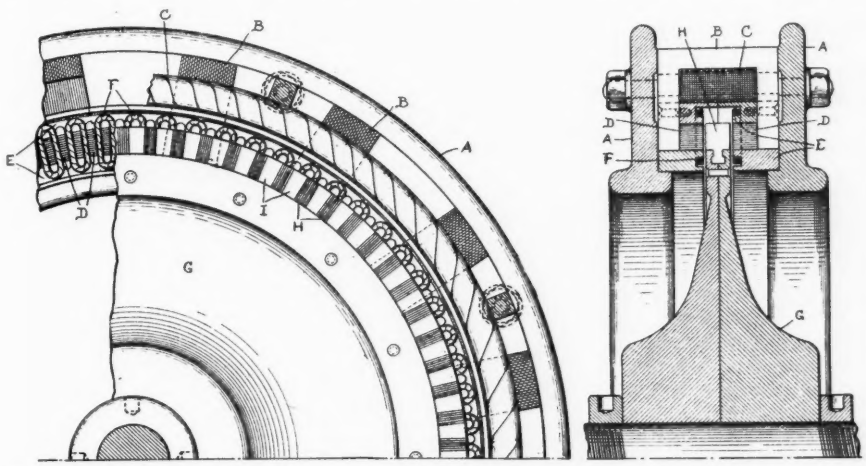
Madame Curie for Paris Chair of Physics.

Mme. Curie, who jointly with her husband, the late Professor Curie, discovered radium, has been appointed Chief Professor of Physics in the Faculty of Science at Paris University. This is a recognition, well earned, which will be appreciated and commended by all interested in this remarkable woman's work in pure and applied science.

An Inductor Alternator as a Telephone Relay.

It has sometimes been proposed to employ as telephone relays direct-current dynamos having the field winding in the primary circuit and the armature winding in the secondary circuit, so as to produce in the latter currents of the same frequency and wave form as the currents in the primary circuit. The operation of such devices is interfered with by the disturbing effect of the collecting devices, and no relay of this type is in commercial use.

An invention of Ernst F. W. Alexanderson of Schenectady, N. Y., has been recently patented and assigned to the General Electric Company, and consists in using a high-frequency inductor alternator as a telephone relay. In such a machine both the field winding and the armature winding are stationary; the only moving part is the inductor, which is magnetized by the field winding. The inductor is designed so that its natural frequency, which is determined by the number of its poles and its speed, is very high compared with the frequency of the currents in a telephone circuit, so that each wave or pulsation of the telephone current corresponds to a large number of the alternations due to the movement of the inductor. The variation of the current in the primary circuit in which the field winding is connected does not change the frequency of the armature currents, but does change the amplitude of these currents; and if their frequency is above that of an audible note, the effect on a telephone receiver is simply that of the variation in amplitude, which corresponds to the variation of current in the primary circuit.



FIGS. 1 AND 2.—PARTIAL END VIEW AND CROSS-SECTION OF INDUCTOR ALTERNATOR.

In Fig. 1 is shown a partial end view, partly in cross-section, of an inductor alternator designed in accordance with the invention for use in a telephone relay; Fig. 2 shows a side elevation of the same. A A represent end frames, between which the magnetic circuit of the stator is secured. This comprises bundles of laminations B B, arranged radially and surrounding the field coil C, which extends circumferentially around the machine, and the laminations D, which extend in a circumferential direction, and form with the laminations B a nearly closed magnetic circuit for the field winding C. The laminations are supported and spaced apart by non-magnetic spacing blocks E. The air-gap in the magnetic circuit of the stator has its opposite faces lying in adjacent radial planes; and in slots on these faces are placed the coils F of the armature winding.

The inductor G is shaped for maximum strength with respect to centrifugal strains, in order that it may be operated at very high speeds. It carries at its rim magnetic poles H formed of small bundles of laminations, which revolve between the opposite faces of the magnetic circuit of the stator. Non-magnetic blocks I are placed between the magnetic poles H, in order to strengthen the poles mechanically, and to decrease winding losses.

The field winding C is connected in circuit with a source of current and a telephone transmitter, either directly or through a transformer, according to common telephone practice. The armature winding F is connected in circuit with a suitable receiving device, which may comprise a liquid receiver of a type well known in wireless telegraphy, and a telephone receiver and a source of current connected in shunt to the liquid receiver; the principle of this arrangement being that the high-frequency alternations impressed on the liquid receiver vary its resistance, and the resistance variations result in current variations in the telephone receiver, which are audible therein.

The principle of operation of this telephone relay is as follows: The currents in the armature or transmitter circuit vary in amount when a message is being transmitted, and this variation is both in amplitude and frequency corresponding to the sound waves. The currents induced in the armature winding are of a high frequency, compared with the currents in the primary circuit. The frequency of these currents is not affected by currents in the primary circuit, but their amplitude is affected and varies in proportion to the primary current. The frequency of the armature currents is so high as to be inaudible in a telephone receiver, but the variation in amplitude produces audible sounds in the receiver of similar quality to, but of greater amount than, those that would be heard if a telephone receiver were substituted for the field winding of the alternator in the primary circuit.

It has already been stated that the stator laminations D extend circumferentially, while the laminations B, forming the greater part of the magnetic circuit, extend radially. The purpose of the circumferential arrangement of the laminations D is to localize the flux variations due to the high-frequency armature currents. Since the laminations in which the armature coils are placed extend circumferentially, the flux due to the currents in these coils can close itself directly around the coils, without producing any variations in the main part of the magnetic circuit.

Projected Bank for Electrical Undertakings.

It is announced in the *Frankfurt Gazette* that some of the great German electrical firms propose to form a special banking institution to finance electrical undertakings. It is spoken of as the "Electro-bank." The capital is to be $7,500,000, with a large note issue in the form of bonds carrying interest at the rate of four and one-half per cent. The two companies mainly concerned in the new bank are the Allgemeine Elektrizitäts-Gesellschaft and the Siemens-Schuckert Works. It is understood that only large contracts for government and municipal bodies will be dealt with by the new financial institution, and it is doubtful if proposals of an industrial character will be entertained.

Election Returns by Telephone in Chicago.

Preparations throughout the country for transmitting election returns by telephone were more elaborate this year than ever before. The American Telephone and Telegraph Company, operating its extensive long-distance service, established headquarters in each of the states reached by its lines, comprising essentially all of the country east of the Rocky Mountains. At these headquarters the state returns were gathered and transmitted directly to New York. The returns were there compiled and sent out again all over the country by the long-distance wires, in the form of brief bulletins, telling the principal features of the results on an up-to-the-minute basis. As the information was in general confined to a few of the principal candidates, the results were quickly compiled and reached the entire country in a shorter time, doubtless, than any similar bulletins ever sent out in this or any other way.

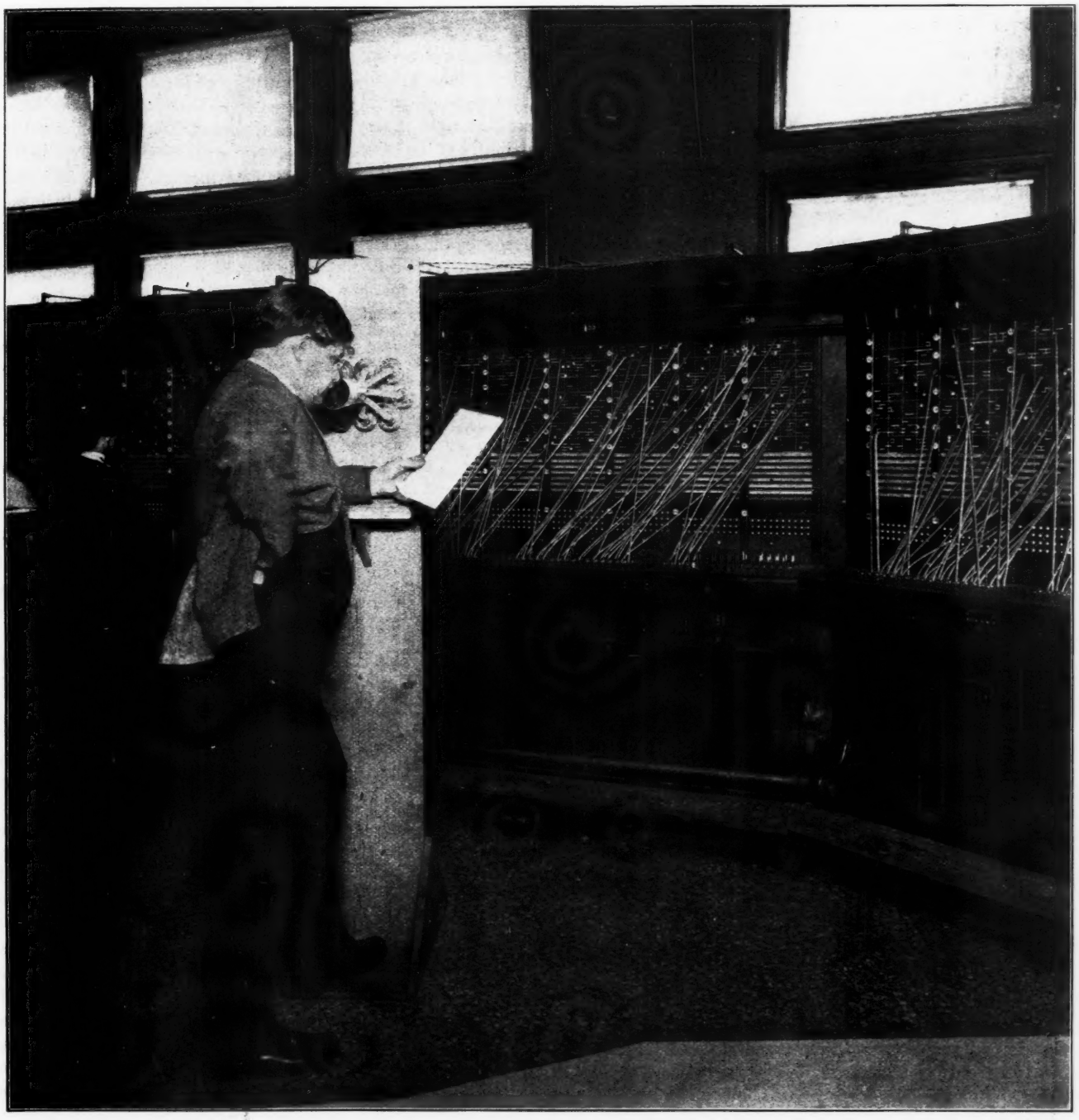
In the large cities special arrangements had been made to gather the returns quickly and transmit them by telephone. In Chicago, by arrangement with the City Press Association, returns from the city precincts were telephoned to the Main Exchange compiling office immediately they were received at the City Hall. Similar means were provided for gathering news in the various counties around Chicago, and these returns were made up into brief bulletins for local distribution and also transmitted to New York.

The Chicago Telephone Company has for many years distributed election news to telephone subscribers generally, as well as to newspapers, clubs and public gatherings. This year the demand for the service was greater than ever before, and preparations for the bulletin transmission were necessarily more elaborate. An entire floor of the company's new toll building at 87 Franklin Street was devoted to this work. Here were gathered about 175 men, engaged in receiving, compiling, editing and transmitting election news and bulletins throughout the night, and from about 5 o'clock p. m. until after midnight this was the center of election-news activity in the city. A photograph, reproduced herewith, shows the election-news force at work. Three sets of bulletins were prepared; the continuous bulletins, which averaged one a minute, the ten-minute bulletins for Chicago subscribers, and the thirty-minute bulletins for the suburban area. Special readers transmitted the continuous bulletins to newspapers, clubs and various public gatherings. These readers, by a combination of instruments, shown in the accompanying illustration, were able to talk into ten transmitters at the same time, and in some cases four or five lines were

CHICAGO TELEPHONE COMPANY ELECTION SERVICE—TRANSMITTING RETURNS TO 225,000 TELEPHONES IN CHICAGO AND VICINITY.

grouped on to each transmitter circuit. The ten-minute bulletins were transmitted by readers directly to each of the company's twenty-three principal exchanges and ten or more neighborhood exchanges in Chicago. Subscribers of these exchanges desiring to receive the news had simply to ask the operator for telephone bulletins. The operator then announced the number of the current bulletin, and ordered the subscribers' lines connected with a group being formed at that moment; the bulletin reader meanwhile was announcing the bulletin to a group previously made up. At the end of each bulletin the reader switched from one group to the other and proceeded with his work. At the close of each bulletin the subscribers' lines in the group were disconnected, and they were able to call again for the next bulletin. The total number of calls for election news received in this way during the evening was 53,298. The greatest number came from exchanges in the residence districts, where thousands of subscribers heard the latest election news without leaving their own homes.

Many commendations of the press and subscribers have attested to the remarkable telephone-bulletin service throughout the country on election night, and the success of the bulletin transmission has demonstrated once more that the telephone is one of the greatest and quickest news distributors.



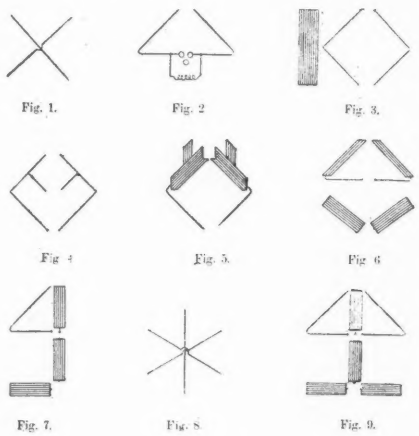
CHICAGO TELEPHONE COMPANY ELECTION SERVICE—READING BULLETINS OF THE ELECTION RETURNS TO MORE THAN 200 TELEPHONES AT THE SAME TIME BY AID OF MULTIPLE TRANSMITTER.

The Artom System of Radiotelegraphy.

Whoever has followed in the slightest the marvelous development of wireless telegraphy must certainly be aware of the serious difficulties that were in the way of the practical application of this wonderful method of communication, says Professor Alessandro Artom in a communication to the Italian Electrotechnical Association, and printed in the "Atti Della Associazione Elettrotecnica Italiana," Vol XII, No. 4, July-August, 1908. It happened continuously that wireless messages sent by a certain transmitting station were caught by all the receiving stations within the circle comprising the average transmitting distance of the station. Atmospheric electricity also caused serious disturbances, so that at times the service had to be suspended for hours. It was necessary to give to the phenomenon of the propagation and reception of the electric waves a much more definite character and, in order to meet the exigencies of practice, it was necessary to develop systems of radiotelegraphy which would make it possible (1) to send the effects of the transmitting apparatus mostly in one definite direction—that is, to find means of directing the electric waves; (2) to render the receiving apparatus most sensitive to waves coming from a certain direction; (3) to prevent the serious disturbances due to atmospheric electricity; (4) to make the receiving apparatus insensitive to waves emanating from extraneous transmitters. Artom says:

"When the work of Marconi was first announced it occurred to me that for a practical solution of the problems mentioned he might have turned to the use of phase difference between two or more electrical oscillations. To produce practically a difference of phase between two Hertzian vibrations of the order employed in wireless telegraphy appeared at that time impossible, but later the idea spread and it is now applied in numerous wireless systems. In my own work I have found it most useful to employ rotating electric and magnetic fields generated by two electrical oscillations differing in phase for proving the existence of phase differences, as will be clearly seen from the experiments here described.

"The rotating magnetic field is generated by two windings, through one of which flows the principal oscillating current, and through the other a current induced by means of a small transformer of a few turns. The existence of the rotating magnetic field can be easily demonstrated by introducing an armature into the field. The existence of very high-frequency rotating electrostatic fields may be demonstrated in various ways, for example, by the use of a Braun tube, which obviously is also eminently suitable for showing the magnetic field. In order to influence the cathode beam of the Braun tube by the vibrations of the high-frequency electric field it is only necessary to fasten to the neck of the tube, a little below the diaphragm, two pairs of tinfoil strips, properly insulated, at right angles to each other on the periphery of the tube, and connect the strips with four points of the oscillating circuit, between which there exist differences of potential out of phase. The effects of a rotating electric field may thus be easily observed; the cathodic spot describes open elliptical forms manifesting themselves in the shape of



SHOWING THE DISPOSITION OF THE CONDUCTING AERIALS USED IN THE ARTOM SYSTEM OF WIRELESS TELEGRAPHY.

spirals, since the oscillations are damped. These elliptical forms, according to which the electric lines of force resulting from the composition of two electrical oscillations of different phase arrange themselves, may conveniently represent a transverse section of a beam of rays of electric force analogous to a beam of light polarized elliptically. Having thus demonstrated experimentally the composition and interference of two electrical vibrations, I endeavored to apply the effect to wireless transmitting and receiving apparatus with a view of producing unsymmetrical electromagnetic fields and devised for this purpose a number of arrangements of aerial conductors which constitute one of the characteristics of my system of radiotelegraphy. They are represented in Figs. 1 to 9, and consist of two or three aerial conductors inclined toward each other at angles which may vary from zero to 180 degrees, but which may generally be most conveniently chosen between forty-five and ninety degrees. When oscillatory currents of displaced phase are sent into aerial conductors arranged in this manner they possess remarkable properties regarding transmission as well as receiving, as experiments made under the auspices of the Italian Royal Navy have shown. As regards the transmitting aerials, the following facts will be observed at once: (1) in the aerials inclined toward each other the mutual induction is very small, when oscillating currents flow through them. This fact permits of establishing absolutely in advance the period of oscillation to be used in the transmission.

"(2) The inclination of the aerials toward each other serves to produce the phenomena of composition and interference between electromagnetic waves emitted by two conductors, because it compels a superposition of the respective beams of electric and magnetic lines of force.

"(3) When connected to an oscillator or to a receiver, these two aerial conductors constitute an arrangement that is in electrical equilibrium, in the sense that the electrical capacities of the two branches, with regard to the earth, are of remarkably equal value, so that the ground connection of the transmitting as well as receiving apparata may be eliminated, as has been demonstrated in practice. This is of practical advantage.

"The various types of aerials shown are approximately equal in their effects, but the triangular arrangement presents some practical advantages in that it requires only one mast. Experience has shown, furthermore, that with this arrangement it is possible to obtain quite well conditions of syntony between transmitter and receiver.

"The characteristic property of the transmitting apparatus is the production of a profoundly unsymmetrical magnetic field, that is, directed electric waves, as the experiments made by the Royal Italian Navy have demonstrated. The use of inclined aerials alone evidently constitutes a reason for the unsymmetrical character of the effects. But an experience of years has demonstrated a property, which is also possessed by some other systems using two aerials, namely, that the axis of propagation according to which the electromagnetic effect reaches the greatest distances, may be perpendicular to the plane of the aerials, or it may lie in the plane of the

aerials themselves. When the oscillating currents in the aerials are made to differ in intensity as well as in phase, that is, if they are of different amplitude, this axis of greatest propagation may be inclined in any direction with respect to the plane of the aerials. This fact is useful in practice, as a wireless telegraph station should evidently be able to meet any special conditions imposed by its topographical position.

"In fact, it is possible to vary the constructive elements or form of these aerials as well as their electrical elements, that is, the amplitude and phases of the oscillating currents by which they are excited. Furthermore, supplementary aerials may be added which, if arranged, as shown in Fig. 4, will greatly reduce the radiation in the direction of the plane of the aerials. Their effect is evidently to generate interfering fields, or fields opposite in sign to the principal electromagnetic field. In experiments made in 1904, in which these aerials were lengthened and arranged almost horizontally in the direction of the receiving station, an increase of radiation in that direction was observed.

"As has been stated, the electrical elements of the apparatus may also be varied; it may be operated with or without ground connection, the difference of phase between the currents may be varied from zero to 180 degrees, and the relation of the amplitude between the two currents may be made to differ. Thus it will be seen that with the arrangement described it is possible to obtain curves of distribution of energy corresponding to the most widely differing azimuth angles, these curves being the natural consequence of the arrangement devised by me.

"In order to apply the idea of phase difference to the reception of signals I devised various types of receiving apparatus, but the one that proved most successful was an arrangement resembling the differential galvanometer, and is illustrated in Fig. 10. Three coils are arranged on a core which may be of insulating material or of iron wires. The central coil is connected to any kind of electric wave detector. Alongside of the central coil are two other coils, each of which has one of its terminals connected to one of the two antennæ, the other ends are joined together and may be connected to the ground or not. These two coils may be made to act by induction on the central coil in such a way that their effects are either in opposition or in accord. When they act in accord on the central coil and the apparatus is connected to the ground, it will receive signals like an ordinary aerial from whatever direction they may come. But when the two receiving antennæ are arranged in the plane of the waves arriving from the transmitter, the waves strike first one aerial and, after a certain time, the other one that is farther removed from the transmitter. The magnetic flux generated in the two coils induces currents in the central coil, which is connected to the detector and behaves

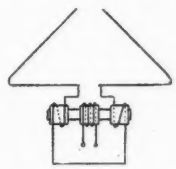


FIG. 10.—ARTOM SYSTEM OF WIRELESS TELEGRAPHY.

according to known laws. Assuming, on the other hand, that the two aerials are affected at the same instant, then the flux generated in the two coils is equal, of the same phase and opposite in direction, and the effect on the induced circuit connected to the detector is practically nil. The result is that from all transmitting stations outside of the plane of the receiving aerials, and more particularly from those stations in a perpendicular direction, the electromagnetic effects arrive at the two receiving aerials at the same instant and the receiving apparatus is not sensitive to them. The same is true in the case of electric waves due to atmospheric electricity. When the ground connection is eliminated the two coils may be dispensed

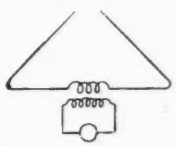


FIG. 11.—ARTOM SYSTEM OF WIRELESS TELEGRAPHY.

with and the apparatus assumes the simple form shown in Fig. 11, and its operation is then principally due to the electromotive force resulting from the magnetic flux traversing the space included by the aerials. The effect is maximum when transmitting and receiving aerials lie in the same plane. This physical fact was made use of by me in the fall of 1905 with very good results for determining the position of transmitting stations on vessels and on land.

"The selective properties of my receiver with triangular aerials have been made still more distinct by the use of electromagnetic syntony, and special apparatus were invented in which, in addition, local syntony was employed, that is, the apparatus has a slow natural period of vibration at which alone it will operate. This local syntony is determined, as regards the transmitter, by the low-frequency current feeding the coils or transformers and, as regards the receiver, by a very weak alternating current under the influence of which only the receiver can act. This apparatus was devised about two years ago, and in experiments made proved to be very sensitive and well suited as a receiver in wireless telephony."

Annual Meeting of the American Society of Mechanical Engineers.

The twenty-ninth annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies' Building, New York, on December 1 to 4, inclusive. The opening session will be held on Tuesday evening, when President M. L. Holman will make an address on "The Conservation Idea as Applied to the Associated Societies of Mechanical Engineers," which will be followed by an informal reception and reunion.

On Wednesday morning, following the annual business meeting, a paper on "Aeronautics" will be presented by Major G. O. Squier, U. S. A. The afternoon will be devoted to four papers relating to steam and power plants, among these being one by C. R. Weymouth on "Fuel-economy Tests at a Large Oil-burning Electric Plant." In the evening Lieut. F. P. Lahm, U. S. A., will deliver a lecture on "Aeronautics," illustrated by stereopticon views and moving pictures.

On Thursday morning five papers on machine-shop practice will be presented and discussed. In the afternoon while the main body will consider five miscellaneous papers, the Gas Power Section will take up two papers by Prof. F. C. Wagner and L. H. Nash.

On Thursday evening the annual reception will be held, followed by dancing and a collation.

The professional sessions will be concluded on Friday morning with the consideration of four papers giving various experimental methods and results. Among these will be one on "An Averaging Instrument for Polar Diagrams," by Prof. W. F. Durand.

At the annual meeting last year 1,232 members and guests were present. This number, it is believed, will be greatly exceeded this year.

SOME PRELIMINARY STEPS IN HYDRO-ELECTRIC ENGINEERING.

BY FRANK KOESTER.[1]

In developing waterpowers much preliminary study has to be made to ascertain whether or not the proposition will be a paying one. A lot of facts have to be collected before capitalists can be interested in the project, showing them where and how they can receive the best returns from their investment.

Usually the first steps toward a waterpower development are made by some progressive individual in the neighborhood of an undeveloped waterpower and not by the manufacturer or power user with an already established steam-generating station, who in some respects even tries to handicap the development for fear of the partial loss of the money invested in his old plant. He overlooks the fact, however, that current may be purchased much cheaper from a main central station than his own plant can generate it. Besides this, he is relieved of the work of generating current and has additional ground area for increased manufacturing purposes.

Another reason why a promoter can best, and possibly with greater success, further the scheme of development is because he has the interest of the community at large under consideration, while the individual manufacturer looks after his own interests alone. Again, the endeavor of the promoter is to utilize as much energy as possible, while the manufacturer utilizes only a portion, which is sufficient for his own needs.

In some localities, particularly when he comes from the "outside," the promoter is looked upon as a persona non grata, while in reality he is a benefactor. Through his efforts and the supplying of current the industry will be improved and in some cases new industries previously unknown will arise. This is not only a direct benefit to the community, but even the towns and counties will be benefited by the increase in revenues, taxes, etc.

After the investigations are made, showing the amount of the energy that can be utilized, the possible field of consumption must be carefully mapped out. This field may include other central stations, either steam, gas or other waterpower plants, with which the new station has to compete. While it is known for what price the established plants sell their current, it might appear on the surface difficult to ascertain what the existing companies pay for the generation of the same. There are, however, several ways by which this information may be obtained, and with the help of an experienced investigator who is thoroughly familiar with plant installations, very close figures can be ascertained.

These figures are very essential as a guide for the new development, because the new arrival has to compete with or possibly sell current to established stations at a lower price than they can generate it. This might lead to the operation of the stations in parallel, or eventually the incorporation of the old with the new concern and the gradual acquisition of the competitor's field. All this can only be accomplished by deciding the question, who can generate power the cheapest?

Having arrived at the competitor's figures, the prospective field for current consumption must be thoroughly canvassed to ascertain the load on the plant and the price for which the current of the new undertaking can be sold. In analyzing the cost of the current to be sold, of course, different prices are charged, according to the amount, duration and time of load. Conclusions as to the cost of current can only be derived after trial load curves of the proposed plant have been plotted.

Such plants will be most economic in operation which have a practically constant load-factor, as otherwise much machinery has to remain idle during the twenty-four hours. However, in competing successfully with existing central stations or private plants the new arrival cannot afford to overlook would-be consumers who require current for only a few hours each day, or possibly the week, and those which need emergency current in case their own plant should fail. That these consumers pay accordingly for the service rendered is but natural. It must, however, be borne in mind that the lower the price for current delivered the greater is the tendency to improve the load curve of the plant.

After the foregoing investigations have been made and the figures warrant an installation, the possible future growth of the locality, such as the increase in industrial districts, electric railroading, etc., must be well considered, since an increase of the community is naturally followed by an increase in consumers.

Many times hydro-electric plants have been installed with no provision for future extension; the dams are located in such sections of the rivers and are of such a design that an increase in storage supply or additional head is impossible. On the other hand, and to a still greater extent, plants have been installed at such sections of rivers or localities that the average water supply cannot be obtained during certain seasons of the year. While the former may be due to the failure to exercise sufficient foresight, the latter may be considered as negligence in proper investigation as to the watershed, etc. Under such conditions successful competition with existing plants would be a difficult proposition in the long run.

Waterpower plants do not in many cases have to meet with competition, as they may be the pioneers in the field. If other conditions are favorable to the development of a certain waterpower the hydraulic plant may be combined with a steam or gas-driven plant to take care of low water conditions and peak loads.

The equipment of the plant and the size of the units should be such that they can be run to their best efficiency throughout the day, that is, they must not be underloaded or overloaded too much. Reserve units must be kept in readiness to be thrown on the line when the demand calls for them. The tendency is to install as large individual units as possible.

In closing it may be said as a general rule that promoters and financiers look usually for large waterpower developments, while as a matter of fact small plants give a better and quicker return for the money invested.

[1] Consulting engineer, New York city.

Court Reserves Decision in New York City's Application to Examine Edison and United Electric Books.

Justice McCall, in the New York Supreme Court, reserved decision on the application of the city of New York for an order authorizing it to examine the books and plants of the New York Edison Company and the United Electric Light and Power Company.

The corporation counsel said that he desired the examination for the purpose of defending the suits brought by the two companies to recover about $500,000 for furnishing electricity to the city for the year 1903.

Counsel for the electric light companies said that all the information that could be obtained by such an examination was contained in the public records of the report of the Stevens investigating committee of 1905, and asked the court to deny the application.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

CHICAGO RAILWAYS.

The Chicago Railways Company reports earnings for the month of August and seven months (February 1 to August 31) as follows: August—Passenger earnings, $959,167; other income, $20,999; total gross, $980,166; expenses, $650,128; balance, $330,038; balance, 30 per cent of gross, $294,049; interest on property, five per cent, $144,250; net earnings, $149,799; city's share, 55 per cent, $82,389; company's share, 45 per cent, $67,409, as against $95,621 for August, 1907. February 1 to August 31—Passenger earnings, $6,128,269; other income, $132,514; total gross, $6,260,783; expenses, $4,287,024; balance, $1,973,759; balance, 30 per cent of gross, $1,878,233; interest on property, $971,230; net earnings, $907,003; city's share, 55 per cent, $498,851; company's share, 45 per cent, $408,152, which compares with $442,503 for the corresponding period of 1907.

SEATTLE LIGHTING COMPANY BONDS.

The Seattle Lighting Company recently sold $450,000 ten-year, six per cent debenture gold bonds, redeemable on any interest day, at 101. This is added to an authorized issue of $3,000,000 of five per cent bonds, which makes the authorized bonded debt of the company $3,450,000. The financial statement showing funded debt charges is as follows for the year ended July 31, 1908: Gross earnings $560,325; net (after insurance and taxes), $252,695; interest on mortgage bonds, $124,073; interest on debentures, $27,000; balance, surplus, $101,622. Net earnings for the year ended June 30, 1908, were $252,287 and for 1907, $218,972.

There is an equity in the property over and above all the first mortgage bonds outstanding of approximately $1,500,000, which equity stands as security for this issue of $450,000 debenture bonds.

PHILADELPHIA COMPANY.

The report of the Philadelphia Company and affiliated corporations shows earnings from all operations for the nine months ended September 30, 1908, as follows: January 1 to September 30: Gross, $12,261,314; expenses and taxes, $7,453,833; net, $4,807,481; other income, $193,834; total income, $5,001,315; charges, rent, etc., $3,351,513; balance, $1,649,802; preferred dividend, $225,000; surplus, $1,424,802, compared with $1,969,602 for the same months in 1907.

BOSTON ELEVATED.

The annual report of the Boston Elevated Railway Company for the year ended September 30, 1908, shows as follows: Gross, $14,074,696; expenses, $9,454,386; net, $4,620,310; total increase, $4,620,310; charges, $2,780,246; surplus, $840,064; dividends, $798,000; surplus, $42,064, which compares with $33,278 for 1907. The balance sheet as of September 30, 1908, shows assets of $35,428,644 and a surplus of $2,717,980, which includes $2,036,900 premiums received from the sale of securities in 1907 and $2,007,314 in 1908. The number of revenue miles was 51,625,143 and the passengers carried 273,132,584.

KANSAS CITY RAILWAY AND LIGHT.

The report of the Kansas City Railway and Light Company for the month of September and four months ended September 30, 1908, is as follows: September gross, $537,301; expenses, $289,330; September net, $247,971; charges and taxes, $155,181; September surplus, $92,790, as against $115,786 for September, 1907. Four months' gross, $2,113,843; expenses, $1,212,137; four months' net, $901,706; charges and taxes, $620,530; four months' surplus, $281,176, comparing with $394,937 for the corresponding period of 1907.

ELECTRICAL SECURITIES CORPORATION.

The Electrical Securities Corporation, which is the holder of mortgage bonds of certain electric railway, light and power companies, has issued its report for the year ended October 31, 1908. The profit and loss account shows as follows: Bond interest received and accrued, $292,279; dividends on stocks, $56,735; total, $349,014; collateral trust bond interest, $137,712; interest general account, $17,672; expenses, $52,811; total expenses, $208,195; net profit, $140,819; profits from sale of securities, $4,101; total net profit, $144,920; previous surplus, $868,885; total surplus, $1,013,805, decrease in value of assets, $402,594; baalnce, $611,211; preferred dividend, $50,000; profit and loss surplus, $561,211, as against $868,886 for the year 1907. The statement of assets and liabilities as of November 1, 1908, shows total assets of $8,166,893, compared with $7,443,826 for the previous year.

INTERNATIONAL RAILWAY COMPANY.

The International Railway Company of Buffalo, N. Y., report as filed at Albany for the quarter ended September 30, 1908, is as follows: Gross, $1,349,900; expenses and taxation, $798,102; net, $551,798; other increases, $6,052; total increases, $557,850; charges, $224,768; surplus, $333,082, as compared with $415,389 for the corresponding quarter of 1907. The assets are given as follows: Cost of road, $31,536,025; interest and dividends receivable, $7,291; material and supplies, $386,053; cash assets, $436,293; accounts receivable, $608,271; International Traction Company car trust license account, $1,349,389; funded debt of other corporations, $360,000; stock of other corporations, $61,200; special deposits, $106,852; prepayments, $62,526; grand total, $34,913,903. Liabilities—Funded debt, $10,858,000; current liabilities matured and unpaid, $164,739; current liabilities unmatured, $534,272; loans, International Traction Company, $4,672,593; reserve for replacement and renewals, $91,322; other reserves, damages, $190,136; stocks, International Traction Company car account, $697,249; real estate mortgages, $38,850; common stock, $16,320,500; corporate surplus, $1,346,239; grand total, $34,913,903.

The Crosstown Street Railway of Buffalo, which is controlled by the International Railway Company of Buffalo, reports for the quarter ended September 30 as follows: Gross, $167,933; expenses and taxation, $101,759; net, $66,174; charges, $37,175; surplus, $28,995, as against $38,088 for the same quarter of 1907.

FONDA, JOHNSTOWN AND GLOVERSVILLE.

Fonda, Johnstown and Gloversville's report, as filed at Albany, N. Y., for the quarter ended September 30, 1908, shows as follows: Gross operating revenue, $224,720; operating expenses, $100,205; net operating revenue, $124,515; other net revenues, $2,244; total net revenue, $126,759; taxes accrued, $8,250; operating income, $118,509; other income, $4,862; gross income, $123,371; charges, $85,907; net income, $37,464, as against $53,615 for the corresponding period of 1907. The cash on hand September 30, 1908, was $32,581; profit and loss surplus, $479,769.

AMERICAN TELEPHONE.

The net earnings of the American Telephone and Telegraph Company for October and ten months ended October 31, 1908, are as follows:

Month of October: Dividends, $2,516,541; interest and other revenues, $789,-

921; telephone traffic net, $491,887; real estate, $15,382; other sources, $81,493; total earnings, $3,895,223; expenses, $164,305; net, $3,730,918; interest, $666,100; balance for dividends, $3,064,809, which compares with $2,568,707 for October, 1907. January 1 to October 31—Dividends, $12,550,557; interest and other credits, $8,087,075; telephone traffic, net, $3,473,494; real estate, $135,516; other sources, $647,908; total earnings, $24,894,552; expenses, $1,736,060; net, $23,158,492; interest, $6,380,746; balance for dividends, $16,777,746; dividends, $9,289,624; surplus, $7,488,122, against $5,822,790 for the same months of 1907.

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction and Light Company for the month of October and ten months ended October 31 is as follows: October gross, $157,532; expenses, $90,238; October net, $67,274; charges, $43,779; October surplus, $23,495, an increase of $9,274 over the corresponding figure for 1907. Ten months' gross, $1,579,081; expenses, $913,301; ten months' net, $665,780; charges, $435,783; ten months' surplus, $229,997, as compared with $263,257 for the preceding year.

SUSQUEHANNA RAILWAY LIGHT AND POWER.

The Susquehanna Railway, Light and Power Company's report for the year ended June 30, 1908, shows as follows: Receipts from subsidiary companies, interest on bonds owned, etc., $551,479; interest on bonds and dividends on stocks of subsidiary companies, $244,980; balance available for dividends, $306,499; dividends, 131,632; undivided surplus, $174,867. The surplus available for dividends is equal to five per cent on the preferred stock and 2.5 per cent on the common stock.

During the year a sum in excess of one million dollars was authorized and expended for extensions, additions and betterments to the various properties, which expenditures were authorized to meet absolute requirements made necessary by increased business.

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of October and ten months ended October 31 shows as follows: October gross, $949,914; expenses, $572,325; October net, $377,589; charges, $233,846; October surplus, $143,743; ten months' gross, $8,810,538; expenses, $5,645,405; ten months' net, $3,165,133; charges, $2,321,176; ten months' surplus, $843,957, a decrease of $22,013 over the preceding year.

GALVESTON-HOUSTON ELECTRIC.

The report of the Galveston-Houston Electric Company for the month of September and twelve months ended September 30, 1908, is as follows: September gross, $91,790; expenses, $46,620; September net, $45,170; charges and taxes, $17,450; balance, $27,720; sinking fund, $2,670; September surplus, $25,050, a decrease of $164 over September, 1907; twelve months' gross, $1,060,002; expenses, $620,378; twelve months' net, $439,624; charges and taxes, $209,812; balance, $229,812; sinking fund, $31,427; twelve months' surplus, $198,385. a decrease of $6,393 as compared with the preceding year.

SEATTLE ELECTRIC.

The report of the Seattle Electric Company for the month of September and twelve months ended September 30 shows as follows: September gross, $385,946; expenses, $209,952; September net, $175,994; charges and taxes, $86,001; balance, $89,993; sinking fund, $7,344; September surplus, $82,649, an increase of $15,839 over September, 1907. Twelve months' gross, $4,425,520; expenses, $2,670,185; twelve months' net, $1,818,335; charges and taxes, $965,519; balance, $852,816; sinking fund, $88,579; twelve months' surplus, $764,237, a decrease of $20,641 as compared with the corresponding period of 1907.

DALLAS ELECTRIC.

The report of the Dallas Electric Corporation and subsidiary companies for the month of September and twelve months ended September 30 shows as follows: September gross, $95,842; expenses, $63,080; September net, $32,762; charges and taxes, $24,623; balance, $8,139; sinking fund, $3,333; September surplus, $4,806; twelve months' gross, $1,148,061; expenses, $772,430; twelve months' net, $375,631; charges and taxes, $313,411; balance, $62,220; sinking fund, $40,000; twelve months' surplus, $22,220, a decrease of $3,376 as compared with the surplus for the previous year.

MINNEAPOLIS GENERAL ELECTRIC.

The report of the Minneapolis General Electric Company for the month of September and twelve months ended September 30 shows as follows: September gross, $81,898; expenses, $34,413; September net, $47,485; charges and taxes, $32,310; September surplus, $15,175; twelve months' gross, $973,993; expenses, $432,362; twelve months' net, $541,631; charges and taxes, $365,542; twelve months' surplus, $176,089, a decrease of $29,190, as compared with the figure for the preceding year.

INTERBOROUGH RAPID TRANSIT.

Interborough Rapid Transit report, as filed with the Public Service Commission, for the quarter ended September 30, 1908, shows as follows: July 1 to September 30—gross, $5,328,887; expenses, $2,675,709; net, $2,653,178; other income, $337,175; total income, $2,990,352; interest on funded debt, $500,000; property taxes, $87,627; special franchise taxes, $310,000; balance, $2,092,726; rentals, $1,998,429; discounts and expenses, $3,108; surplus, $91,189, a decrease of $115,902 over the corresponding quarter of 1907. The income accounts of the two divisions of the Interborough Rapid Transit Company, showing the amount contributed by each toward the quarter's earnings, follow: Main division—gross, $3,093,838; expenses, $1,587,198; net, $1,506,640; other income, $129,330; total income, $1,635,970; property taxes, $72,627; special franchise taxes, $310,000; balance, $1,253,343; rentals, $1,462,656; deficit, $209,313. Subway division—gross, $2,235,049; expenses, $1,088,511; net, $1,146,538; other income, $207,845; total income, $1,354,383; interest on funded debt, $500,000; property taxes, $15,000, balance, $839,383; rentals, $535,773; discount and expense, $3,108; surplus, $300,502.

Purdue Students' Inspection Trip.

About seventy students, members of the senior class in the electrical department of Purdue University, were the guests of the Fort Wayne Electric Works Company on November 11. During the day after inspecting the Fort Wayne plant the party visited the plants of the Hoffman Street Lamp Company and the power plant of the Fort Wayne & Wabash Valley Traction Company. Prof. C. F. Harding, Prof. H. T. Plumb and W. T. Small, of the Purdue electrical faculty, accompanied the students.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER I. (PART IX.)—POLYPHASE CURRENTS.

CURRENT AND VOLTAGE RELATIONS IN THE Y SYSTEM.

The relation between the electromotive force generated in one coil of a Y or star-connected, three-wire, three-phase system and the potential difference between the two transmission wires connected to their terminals is determined as shown in Fig. 28. AO, OB and OC represent the three electromotive forces generated in each of the coils A, B and C of Fig. 25. They are 120 degrees out of phase with each other, just as the currents are. The potential difference between any two transmission lines is the resultant of the electromotive forces generated in the two coils connecting them, as represented in Fig. 25, printed last week. There, A, B and C represent the coils, and the potential difference between mains 1 and 3 is equal to the resultant of the electromotive forces generated in coils A and B. It is, in fact, equal to the difference between the electromotive force generated in A and that generated in B when the difference in phase between the two is taken into consideration.

Let OA in Fig. 28 equal the electromotive force generated in coil A and OB that generated in coil B. The sum of the two is equal and opposite to OC, but OB — OA is the resultant of OB and OF, since OF = — OA. If the positive sign represents action in one direction the negative represents action in the opposite direction. The resultant, therefore, of OB and — OA equals that of OB and OF, or OD. It can be shown mathematically that $DO = \sqrt{3}\ OB$.

If OB = E the electromotive force generated in each coil, and E′ that between two mains, or DO, then

$$E' = E\sqrt{3}.$$

The current flowing in the mains is the same as that flowing in the coils.

CURRENT AND VOLTAGE RELATIONS IN Δ SYSTEM.

If the lines AO, OB and OC of Fig. 28 be used to represent a current of strength I flowing in each of the coils of a three-phase, three-wire delta-connected system, then in a similar manner the current in the mains will be found to be $I\sqrt{3}$. The electromotive force between the mains is the same as that across the coils.

RECEIVING CIRCUITS FOR POLYPHASE CURRENTS.

Unless otherwise stated, it is always assumed that the load on a polyphase system is balanced; that is, equal amounts of power are drawn from each circuit. The method of connecting receiving circuits for accomplishing this is practically a reverse method of that of the generating connections. In a two-phase, four-wire system containing motors at the receiving end the windings of the latter would correspond to those of the generator, each of the two phases taking its share of the load.

In a three-phase system the motors would have three separate windings and

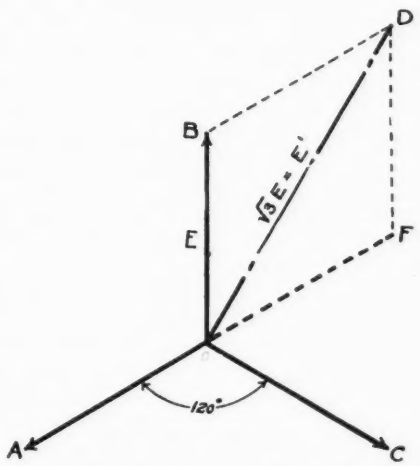


FIG. 28.—DETERMINATION OF ELECTROMOTIVE FORCE IN ONE PHASE OF Y-CONNECTED THREE-PHASE SYSTEM.

each phase would take its share of the load.

When electric lights are connected in a polyphase system they are so arranged that each phase carries the same number, thus maintaining the balance. For example, if twelve lamps are to be connected to a three-phase system, such as was illustrated in Fig. 25, four would be connected between mains 1 and 2, four between mains 2 and 3 and four between mains 3 and 1.

POWER IN POLYPHASE SYSTEMS.

The current flowing through each receiving circuit of a three-phase, Y-connected system is the same as that in the main, but the voltage is $\frac{1}{\sqrt{3}}$ of that between the mains. Representing the latter by E and the former by I, the energy delivered to one phase of the receiving circuit is $\frac{IE}{\sqrt{3}}$, and that delivered to all three phases is $\frac{3IE}{\sqrt{3}}$, or $\sqrt{3}\ IE$.

In the Δ system of connection, let the voltage between the mains, which is the same as that over the coils, be represented by E. The current flowing in the coils is $\frac{1}{\sqrt{3}}$ of that in the main, and the energy delivered to each phase of the receiving circuit is therefore the same as in the Y-connection, that is, $\frac{IE}{\sqrt{3}}$, giving a total of $IE\sqrt{3}$ for all three phases, as before. These calculations are made with the assumption that the load is not reactive, the power being factor unity. If this is not the case, then the total energy delivered is represented by

$$W = IE\sqrt{3}\cos\phi,$$

where $\cos\phi$ is the power-factor.

ECONOMY OF POLYPHASE TRANSMISSION.

Not only is there an advantage in the operation of motors from polyphase circuits as compared to the use of single-phase transmission lines, but there is also a saving in the copper necessary to transmit a given quantity of energy, as is shown by the following calculation:

The current in one coil of a delta winding of a three-phase generator is equal $\frac{1}{\sqrt{3}}$ of that of the current I in the line, as already stated. The energy absorbed in one coil equals $\frac{IE}{\sqrt{3}}$, where E equals the voltage between two lines, and the energy absorbed in all three coils equals $IE\sqrt{3}$. With the Y-connection the power delivered is the same as already stated. Let the resistance of one line be r, with a current I flowing, the loss in transmission in all three lines is $3\ I^2r$. Consider a single-phase system transmitting the same power and let x equal the resistance of one line; 2x is then the total resistance. The voltage being E, the current will be $\sqrt{3}\ I$, and the loss will be $6\ I^2x$. If the losses are the same in the single-phase and three-phase systems

$$6\ I^2x = 3\ I^2r,$$

or

$$x = \tfrac{1}{2}\ r;$$

that is, the resistance of one of the two wires of the single-phase system will have one-half the resistance of one of the wires of the three-phase system. It appears, then, that the total weight of copper required to transmit the same energy on a three-phase system is three-quarters of that required on a single-phase system.

[To be continued.]

Association of Car-Lighting Engineers.

Wednesday and Thursday Sessions. Election of Officers. Trip to Milwaukee.

Although its first convention, the meeting of the Association of Car-Lighting Engineers held in Chicago during the five days ending Friday, November 20, demonstrated by attendance and interest the important and useful part the association is to take in the railroad and electrical fields as the art of electric train-lighting progresses. The sessions of the convention were held in the German Room of the Grand Pacific Hotel, and a number of manufacturers occupied adjacent parlors with exhibits of a character interesting to the car-lighting engineers. The banquet in the hotel dining room on Wednesday evening proved the high-water mark in point of attendance, about 200 members, associates and guests being present.

Among the papers read and reports submitted during the first two days of the convention, as reported in full in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of last week, were the following:

Monday morning—"The History of Car Lighting," by Patrick Kennedy. "The History of Axle Lighting," by W. L. Bliss. Monday afternoon—Report of the committee on "The Care and Maintenance of Storage Batteries," by F. R. Frost, chairman. "Railway Train Lighting," written by the late A. H. Bauer in 1892. Tuesday morning—Report of the committee on "Straight Electric Lighting," by C. W. Bender, chairman. Report of the committee on "Organization and Systemization in Connection with Electrically Lighted Trains," by E. W. Jensen, chairman.

On Wednesday the association listened to the report of the committee composed of C. R. Gilman, Fred McGary and W. L. Bliss, on the subject of "Head-End Lighting of Passenger Trains."

A head-end system of electric train lighting, the paper defined as a system in which current for all the lamps in the train is derived from a comparatively large dynamo at the head end of the train. This may be, first, a steam-driven dynamo situated on the locomotive; second, a dynamo situated in the baggage car, operated by a belt from the car-truck axle; third, a steam-driven dynamo situated in the baggage car. The same general details go with each of these systems and each requires the storage battery as an auxiliary.

Taking up these systems in detail, there are:

First—Dynamo on locomotive, driven by steam turbine. There are at least two systems of this type on the market, worked out in detail and ready to demonstrate their efficiency as a means to electric-light trains. They are more or less automatic in their operation and aim to reduce the personal equation in the handling to a minimum.

Second—Large axle-driven dynamo situated in baggage car. This system is being worked out by one railroad, and its designer believes in it thoroughly. He is using a double-belt drive. Another arrangement of driving the dynamo has been worked out by a well-known car-lighting company. These systems are reducing the automatic features to a minimum, and this committee is inclined to agree with them, as past history, if observed, is not impressive as to the value of automatic devices operating in railroad service.

Third—Turbine-driven dynamo in baggage car. This system is more generally understood and is in use on quite a number of prominent railroads with fairly good results. In most cases it is being used in connection with gas or oil as an auxiliary light and has proven very economical.

A valuable feature of this report was an itemized statement of the expense incurred by a certain large railroad, operating 900 cars over 7,500 miles of track, in changing over to the head-end system of electric lighting, using turbines deriving steam from the locomotive boiler, and several large batteries in each train. The investment was summed up to be $577,139 for equipping 121 baggage cars with turbine sets and installing wiring and storage cells in other cars. This investment, while very large, the committee thought to be a fair estimate, and believed that no other system could be employed for the same amount. It has been in use for a number of years and has proven its reliability. A table submitted, showing the failures of this system on the Chicago, Milwaukee & St. Paul Railroad, operating 183 electrically-lighted cars in nineteen trains, indicated an average duration without light of only forty-one and one-half seconds per car per day.

The committee on lamps, composed of J. J. Hack, J. M. Schilling, A. J. Farrelly and Ward Barnum, had been instructed to gather information and data regarding the present lamp practice in car lighting and the latest development of incandescent lamps for this service, and to prepare a report on the comparative merits of carbon, tantalum and tungsten lamps. It was found that in the past the car-lighting lamp business was not sufficient to warrant any particular manufacturer to give the necessary attention for its development, especially inasmuch as there are now over twelve different voltages in use on the various roads, ranging from fifteen to 110 volts, and also a like variation in candlepowers.

The report submitted a number of tables showing volts, candlepower, filament, shape of bulb and useful life of a number of carbon, tantalum and tungsten lamps available for train lighting.

Tungsten lamps of low candlepowers cannot be made at present for the sixty-volt system, for the reason that the filament would be too delicate to stand the vibration of the car. However, tests on these lamps have been very satisfactory, and indications are that they may be used similarly to the carbon lamps for train lighting. Sufficient data have been obtained to show that should any fault develop it can be entirely overcome.

It was found impossible to place the tungsten support in the small G-12 bulb used in berth lighting, and to draw the neck small enough to be fitted with a candelabra base. Furthermore, lamps could not be made tipless. The snap lock of the berth receptacle is another feature that must be taken into account in considering the possibility of using tungsten as a high-efficiency berth lamp, on account of jar.

The committee of the lamp manufacturers appointed to investigate thoroughly the requirements of train-lighting lamps at about the same time the association's lamp committee was named, tendered the suggestion that it would be possible to change the voltage of the different systems now in use so as to reduce them to one or two standards, say, a range from twenty-five to thirty-two volts normal for

the low-voltage standard and a range from fifty-five to sixty-two volts normal for a high-voltage standard. The next question arising would be the standard unit to be used in car lighting. Another matter is that of abolishing all special lamps excepting the berth lamp and perhaps two other types, these lamps to be used in all cases where special lamps are now used.

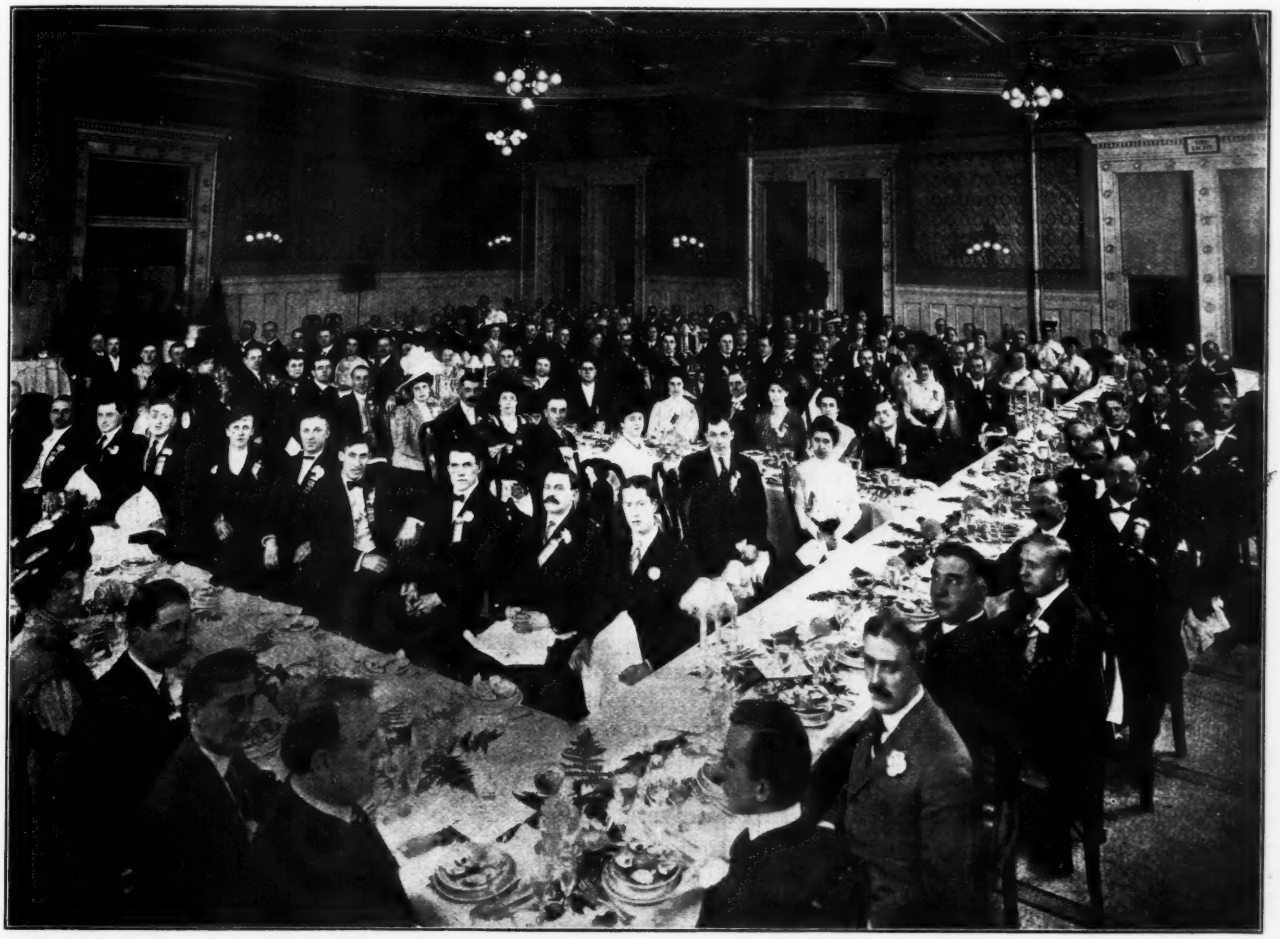
The lamp committee's report concluded with a number of curves furnished by the engineering department of the National Electric Lamp Association, showing comparative performances of carbon, tantalum and tungsten lamps. One of these was especially interesting and showed the saving of one twenty-four-candlepower tungsten over carbon and tantalum of equivalent candlepowers for various costs of power per kilowatt-hour.

Mr. H. C. Meloy's paper on "Illumination," tendered as the report of the committee of which he is chairman, contained the results of a number of tests of the illumination of car interiors with various kinds and arrangements of lights. The author advised the use of lighter colors for finishing the interiors of railroad cars.

In response to the inquiries of a number of the members, W. E. Ballentine of the Rock Island Railroad recounted the experience of his company with Cooper Hewitt mercury-vapor lamps for lighting mail cars. At a cost of $5.35 per car-month for maintenance, these lamps, he said, gave an illumination 570 per cent greater than that obtained with gas. The average life of a tube in this service is 9,000 hours. The lighting system is carried out with fifty-five volts, and on account of the marginal property of the mercury-vapor tube, which prevents its operation unless a certain potential is impressed across the terminals, there is no danger of running down the storage cells to exhaustion or sulphation.

On Wednesday evening the annual banquet of the association was held in the great dining room of the Grand Pacific Hotel. Almost two hundred members, associates and guests attended and enjoyed the excellent and well-appointed service. Following the gustatory courses the banqueters listened to a number of toasts, with Godfrey H. Atkin, of the Electric Storage Battery Company, presiding at the speakers' table. Toasts were given as follows:

"Our Association," President A. J. Farrelly, Electrical Engineer, Chicago & Northwestern Railway; "Car Lighting from an Operating Standpoint," George H. Groce, Superintendent of Telegraphs, Illinois Central Railroad; "Small Beginnings," R. Quayle, Superintendent Motive Power, Chicago & Northwestern Railway; "Buyer and Seller," Colonel J. T. Dickinson, Bliss Electric Car Lighting Company.



BANQUET OF ASSOCIATION OF CAR-LIGHTING ENGINEERS, GRAND PACIFIC HOTEL, CHICAGO, WEDNESDAY EVENING, NOVEMBER 18.

The formal programme was interrupted by G. W. Murray, of the Southern Pacific, who, on behalf of the association, presented President Farrelly and Secretary Colegrove with handsome watch-fobs in recognition of their services to the organization.

On Thursday morning two papers remained for discussion by the convention and the executive session that had been planned was postponed until the after-

noon. The report of the committee on "Practicability of Electric Lighting of Steam-Railway Cars by Straight Storage Systems of Lighting," was presented by W. E. Ballentine, chairman of the committee of which C. J. Causland and R. C. Shaal were the other members.

The efficiency of the straight-storage system, say the committee, is higher than that of any of the other systems. The energy is generated with large, efficient units and is transferred to the lamps in the most efficient manner. There is neither slippage of belts nor wasted energy, as the greatest part of all the energy produced is utilized for the purpose intended. The battery is not overcharged when not necessary. In this connection we must also consider the fact that the straight-storage equipment is considerably lighter than the other equipments and does not utilize as much energy on the road. In the head-end system the energy is taken direct from the locomotive boilers to the generator, and in the axle system the energy is transmitted from the boiler to the engine, to the train, and through the belt to the axle machine.

The cost of maintenance depends largely on the simplicity and efficiency of the system. In the straight-storage system the power plant is stationary and at all times under supervision, which, naturally, will tend to make the maintenance low. The life of the power plant is much longer and the maintenance is much lower than in the other two systems where the power plant is applied to the train and carried back and forth, therefore being subject to considerable strain on account of the jarring. In the straight-storage system the battery is used to its best advantage and is subject to less abuse than with other systems. It will therefore give considerably longer life in this kind of service and will run with less attention. The battery does not receive constant overcharging and overdischarging, causing blowing out of the active material, sulphating, and buckling of plates. The battery is brought up on every charge to the normal point, and, as a rule, is not exhausted on discharge, which very frequently will happen in the other methods. The straight-storage method will work the battery in a regular routine, which naturally gives the most efficient results, and will seldom go to extremes in charging and discharging.

The principal advantage in operating a straight-storage system is the necessity of assigning cars to regular runs and of allowing a sufficient layover for the same between runs in order that the batteries may be properly charged. Ordinarily it takes from six to eight hours to charge the batteries, the time depending on the length of the previous run and also on the charging current available. The next objection to straight storage would be the time-factor, that is, the battery will give only a certain number of car-lighting hours, which makes it impossible to use this system on long through runs. Another serious objection is the impossibility of keeping a constant lamp voltage, which has tendency to greatly shorten the life of the lamps.

The straight-storage system of lighting, the committee concludes, is only practicable where the total car-lighting load, expressed in ampere-hours, does not exceed at the most seventy-five per cent of the rated capacity of the battery. In other words, this means that a factor of safety of at least twenty-five per cent must be allowed to take care of any contingency which might arise from some unknown cause.

A complete analysis of modern axle-driven generating systems was presented by Chester Terry, chairman of the committee on "Axle-Lighting." He described several well-known systems of axle lighting, giving a brief description of the methods of regulation and the distinctive features of the various devices as follows:

"The United States equipment has a shunt-wound generator with one and one-half kilowatts capacity at fifty or sixty volts. The generator regulation is accomplished by varying the pressure on a pile of carbon discs in the field circuit by means of a solenoid which carries the generator current.

"The Newbold device consists of a shunt-wound generator of 2.4 kilowatts capacity at thirty or sixty volts, and a regulator having a field rheostat which is operated by the pull of a solenoid core opposed by an adjustable weight, the action being for any increase in generator current to pull in more resistance in the field rheostat. The solenoid has two windings; one carrying the machine current and the other, which is wound in opposition to the first, carrying the lamp current, so that when the lamps are turned on, the generator output is increased in proportion to the lamp load.

"The Bliss Type F equipment consists of a shunt-wound generator of three kilowatts capacity at thirty or sixty volts, and a regulator which has two permanent resistances in multiple with each other, and in series with the field winding. Each one of these resistances is short-circuited by a carbon-pencil contact. The lower carbons are mounted on solenoid cores. The main winding of the solenoids carries the generator current and the second windings the lamp current. The solenoids thus control the pressure on the carbon-pencil contact and vary the degree of short-circuiting of the permanent resistances in the field circuit; the action being to maintain a constant generator current with an increase when the lamps are turned on. A permanent resistance being cut in series with the lamps when the generator starts to operate.

"The regulation in the Bliss bucker is accomplished by inserting counter-electromotive forces in the field circuit of the generator and in the lamp circuit. The bucker consists of a motor connected across the generator mains and mounted on the same shaft with the bucker proper. This is composed of an armature having two separate windings and two commutators, and is excited by a series field which carries the battery-charging current. The speed of the bucker is practically constant under a load, so that the counter-electromotive force in the field circuit and in the lamp circuit are very nearly proportional to the battery-charging current. It will thus be seen that the principle is to maintain a constant battery-charging current at all times in addition to supplying the lamp load direct from the generator. The current regulation effected is fairly close, but varies considerably for different train speeds, owing to the fact that successive increases in battery-charging current are necessary to cause corresponding increases in the counter-electromotive force in the field circuit. As the counter-electromotive force in the lamp circuit is proportional to the battery-charging current and is not dependent directly on the actual battery voltage, it is evident that variations of battery voltage during charge and from other causes previously mentioned will cause a considerable variation in lamp voltage.

"The Consolidated Type D equipment consists of a three-kilowatt generator at thirty or sixty volts, and the regulation is accomplished by a rheostat in the field circuit which is automatically operated to maintain a constant current with an increase proportional to the lamp load. The current regulation accomplished is very close and is constant for all train

speeds. The lamp regulation is maintained with a variation of one to one-and-one-half volts, by means of an automatically operated rheostat in the lamp circuit. A high-resistance electromagnet is connected across the lamp circuit and operates by means of a small motor and suitable mechanical devices to cut in or out resistance in the lamp circuit on a very small voltage variation. This means of regulation is positive and maintains the lamps at normal voltage regardless of any change of conditions in other parts of the system. The only deficiency in this regulation is that its action is not instantaneous. When a considerable number of lamps are turned on or off a few seconds are required for the rheostat to readjust itself.

"An improvement on this regulator has recently been brought out which acts on the principle of a recording ampere-hour meter, and records the charge and discharge of the battery on a paper roll, giving a complete record of the performance of the apparatus as well as indicating the number of hours' charge in the battery at any time. It charges the battery at its normal rate until about twenty-five per cent overcharged, and then automatically cuts out the generator or cuts it down to a very small current, as desired. As soon as the lamps are burned for half an hour the generator is again cut into service. When there is but an hour's charge at the normal rate left in the battery, all lights except an emergency circuit are cut out, and when one and eight-tenths volts per cell is reached the lights are all cut out. The battery is thus charged at its normal rate and is protected from overcharge and overdischarge, which is certain to add materially to its life. No change of adjustment of the generator current is necessary when a car is transferred from a nearly all-daylight run to an all-night run, as the different conditions resulting are taken care of automotically."

An executive session, attended only by active members, was held on Thursday afternoon for the election of officers and the transaction of other business. The former officers and committees were re-elected in nearly every case. The present list of the officers and the executive committee stands as follows:

President, A. J. Farrelly, Chicago & Northwestern Railway; vice-presidents, A. J. Collett, Union Pacific Railway, C. W. Bender, Pennsylvania Railroad; Secretary and Treasurer, G. B. Colegrove, Illinois Central Railroad.

Executive Committee—H. C. Meloy, Lake Shore & Michigan Southern Railway; A. C. Terry, "Soo Line; G. W. Murray, Southern Pacific Railway; O. W. Ott, O. S. L.; D. J. Cartwright, Lehigh Valley Railroad; C. R. Gilman, Chicago, Milwaukee & St. Paul Railroad.

A smoker on Thursday evening practically closed the convention, although a number of the members stayed over to visit Milwaukee on Friday, inspecting the factories of the Bliss Car Lighting Company, the Cutler-Hammer Manufacturing Company and the Allis-Chalmers Company, and the shops of the Chicago, Milwaukee & St. Paul Railroad.

The second annual convention of the Association of Car-Lighting Engineers will be held at Chicago, Ill., October 5 to 8, 1909.

Among the railroads represented at the convention were:

Illinois Central, G. B. Colegrove, E. W. Jansen, J. C. McElru, G. M. Crownover, F. G. Colwell, J. M. Barrowdale, A. L. Chapin, G. H. Groce, M. J. Clark; Chicago & Northwestern, A. J. Farrelly, W. S. Berry; "Frisco" System, R. N. Massey, C. A. Pinyerd; Southern Pacific, G. W. Murray; Lehigh Valley, D. J. Cartwright; Big Four, J. E. Gunnesse; B. O. & S. W., C. H. Charlton; L. S. & M. S., J. P. Puette, M. E. Seymour, H. C. Meloy, E. A. Humphrey; Missouri Pacific, R. W. Bowler; Pennsylvania, C. W. Bender, O. H. Davis, J. Cosland, C. Canstad; L. & N., J. R. Smith, S. Y. Culley; Union Pacific, A. J. Collett; "Alton," C. L. Abrams, J. F. Bigelow, C. W. Eisenmann; "Santa Fe," S. W. Everett, F. R. Frost; C., M. & St. P., C. R. Gilman, W. O. Davies, H. J. Frank, E. Hiscox; "Soo" Line, Chester Terry; New York Central, A. McGary; Burlington, Fred McGary, H. A. Gardner; Wabash, W. A. Hopkins; B. & O., J. D. Brown; Rock Island, W. E. Ballentine, G. H. Scott, F. E. Hutchinson; Northern Pacific, W. J. Bohan; Canadian Pacific, J. A. Shaw; C. & E. I., J. H. Burcham; New Jersey, M. C. Kershaw; Pullman Company, N. E. Lemmore; and other Members, W. R. Hungerford, Chicago; Dr. C. W. Gould; C. M. Perkins, Chicago; A. H. Darker, London, England.

The following manufacturers and supply companies maintained exhibits in the hotel parlors or had representatives on hand during the convention:

Westinghouse Machine Company, D. C. Arlington, S. B. Dusinberre, Edgar Lewis, L. L. Johnson; Storage Battery Lighting Company, E. H. Clare, Fred W. Hulme; Consolidated Railway Electric Lighting and Equipment Company, P. Kennedy, L. J. Kennedy, Thomas L. Mount, R. C. Haley, B. E. Erickson, C. A. Lathan, A. O. Jackson; Central Electric Company, J. M. Lorenz, J. E. Ham, H. W. Young, F. R. Bryant, Allen S. Pearl; Willard Storage Battery Company, T. Willard, W. D. Callinan, W. C. Egert; General Storage Battery Company, John L. Jones, S. D. Dixon; Gould Storage Battery Company, Dr. C. W. Gould, William A. Farbayne, J. Eisenwest, George C. Milne, M. R. Shedd, George R. Berger; Electric Storage Battery Company, E. H. Atkin, F. T. Rinder, H. E. Huet, I. B. Entz, H. B. Marshall; Bliss Electric Car Lighting Company, W. L. Bliss, J. T. Dickinson, N. T. Sherman, Louis A. Mann, Edwin Tover, Jr.; Holophane Company, V. R. Lansingh; A. & J. M. Anderson Manufacturing Company, William W. Hincher; Buckeye Electric Company, L. P. Sawyer; National Electric Lamp Association, S. E. Doane, W. F. Bauer, E. D. Strickland, J. R. Crowe, H. S. Hall, R. B. Clark; General Electric Company, F. W. Wilcox, J. Scribner, Henry Schroeder, G. C. Osborn; Western Electric Company, J. H. Delaney; International Electric Meter Company, Julian S. Jackson, W. W. Cheney; Bryan-Marsh Company, J. S. Corby, James B. Darragh; American Distributing Company, P. W. Hood; Columbia Incandescent Lamp Company, J. G. Boyd, C. D. Oldham, A. C. Garrison; Westinghouse Lamp Company, B. F. Fisher, Jr., J. M. Schilling; New York & Ohio Company, William R. Collins; Sunbeam Incandescent Lamp Company, T. J. Rider, Jr.

Wireless Telephone Litigation.

The Radio-Telephone Company of New York, N. Y., which operates the De Forest system of wireless telephony, has filed a bill in the United States Circuit Court, at Trenton, N. J., asking for an injunction restraining the Collins Wireless Telephone Company, of Newark, N. J., from infringing on patent rights granted to John Stone Stone, of Cambridge, Mass., for wireless telephones known technically as "space telephones." The Radio-Telephone Company also asks for an accounting. The De Forest company is operating under the patents granted to John Stone Stone, and these patents, it is asserted, cover the entire field of wireless telephony.

Armour Institute Branch, American Institute of Electrical Engineers.

A very interesting paper on the selection of a railway motor equipment was presented before this branch at a recent meeting by G. I. Stadeker. His method of attacking the problem, although simple, may be interesting to many not directly concerned in this class of work.

Having given certain requirements to meet, such as the weight of equipment, rate of acceleration, and schedule, a number of kinds of motors in use on similar installations may be considered in a preliminary determination of the required motor equipment. The tractive effort is calculated for full load at several gear ratios for each one. If any of these values correspond to the tractive effort necessary to produce the required acceleration these motors may be further considered, and speed-time curves, current-time curves and distance-time curves plotted for several gear ratios for each one, and from these the energy required to make the typical run, and the time of run with each gear ratio is determined. Watt-hours per run and time of run are then plotted against gear ratios. The proper gear ratio is that one which will make the run in the fastest time with the least power input. This should be determined for each motor under consideration and the energy required and time of run compared with similar determinations for other motors. The final choice of motor equipment is the result of this comparison. Having determined the gear ratio with any motor, before proceeding in comparison with other motors, it must be ascertained that the heating will not be excessive. The continuous rating or the service capacity curves furnished by some of the leading motor manufacturers make this possible.

A new system of plotting speed-time curves was described. The formula used in determining the time it will take a train to change its speed from any speed S to any other speed $S + \Delta V = S'$ is

$$t = \frac{M \Delta V}{.01098 A}$$

in which

M = mass in tons,
V = increment by which speed changes,
A = average tractive effort during change of speed,
t = time to change from S to S'.

Substituting a range of values of A, keeping Δ V constant, t is calculated, and the values so obtained plotted against A. Referring to the speed and tractive-effort characteristic of the motor under consideration, the average tractive effort exerted while the train increases its speed from S to S' can be obtained, and the time to complete this change obtained directly from the curve. This method has the advantage of simplicity of application, accuracy and elimination of error in calculation.

Ithaca Section, American Institute of Electrical Engineers.

The first meeting of the Ithaca section of the American Institute of Electrical Engineers for the college year was held October 30. The programme comprised an original paper by J. G. Pertsch on the general subject of "Alternating-current Line Losses." Mr. Pertsch gave a summary of the investigations which have led up to Ralph D. Mershon's latest work, with especial reference to the researches conducted locally by Professor Ryan. An abstract of Mr. Mershon's Atlantic City convention paper was delivered by W. K. Page. This was illustrated by lantern slides made for the occasion. The speaker brought out the essential features of the paper and led up to a very interesting discussion by the members present.

This meeting was the first held in accordance with the plan laid out by the local programme committee for the year. The plan is briefly as follows:

Alternate meetings will be occupied with discussions of the New York and other Institute papers and with addresses by prominent local and out-of-town engineers. One subcommittee, under the direction of Prof. F. Bedell, who is also chairman of the entire programme committee, invites and entertains speakers from outside. The other subcommittee known as the discussion committee, under the direction of L. F. Blume, arranges for the abstracts and discussions. In order that this committee may be familiar with the practical experience of the local members, a canvass of the entire junior and senior classes, comprising nearly six hundred men, has been made. Each student has been asked to write down on a printed form every detail of his practical experience. Then in preparing for a given discussion the committee goes over this record, picking out the names of men who have had experience along the line of the paper under discussion. This feature has already proved of the greatest value and was not very difficult to effect.

The discussion committee intends occasionally to try an original experiment by having different local members impersonate the engineers who have discussed the papers at the main Institute meeting. Each will endeavor to obtain the point of view of the speaker, and will be called upon by the name of the engineer whom he impersonates. Two objects will be gained by this procedure. First, the spirit of the New York discussion will be repeated, and second, the students will become familiar with the points of view of successful engineers.

At the present time there are three members and twelve associates connected with the Ithaca section. The secretary has signed the enrollment blanks for 138 students. Altogether the work starts out with good promise of success, largely increased enrollment and excellent interest.

Sidewalk Lighting of Underground Engine Rooms.

The development of the show engine room, with its enameled brick walls, artificial lighting and attractively arranged power units, has awakened a natural interest in the improvement of conditions which have hitherto been considered hopeless. Whitewash and daylight will work marvels in any place. In city plants in particular it is all too often considered that lighting without artificial means is an impossibility. But as a rule such engine rooms are more or less accessible to the transmission of daylight if proper arrangements are provided. The refracting prism has in many cases solved the difficulty by throwing the light far into hitherto dark and dirty corners. So, also, has the sidewalk-vault light, with its numerous lenses.

The effect of such methods is well shown by an illustration of an engine room situated beneath the sidewalk which recently appeared in *Power and the Engineer*. The room is not only lighted—it is fairly brilliant. The sidewalk construction, which was the work of the Aberthaw Construction Company, of Boston, Mass., consists of a series of circular lenses embedded in Portland cement. In form the lens is flat on top, the under side being cupped to refract the light, and the circumference ribbed to insure a joint with the cement. Twisted reinforcing rods are run between the lenses to give stability to the entire structure. This design provides the most essential features in such a sidewalk—namely, the opportunity to prevent leakage. But years of trial have shown that good workmanship, born of experience, is just as essential as the design in securing a result that is waterproof.

CHICAGO ELECTRICAL SHOW.

FOURTH ANNUAL EXHIBITION, AT THE COLISEUM, JANUARY 16 TO JANUARY 30. THE PROMISING OUTLOOK.

The outlook for Chicago's Fourth Annual Electrical Show, which is announced to open in the Coliseum, Saturday afternoon, January 16, and run until Saturday night, January 30, is the most gratifying in the history of these great trade expositions in America. With the show still two months away, more than seventy-five per cent of the space is sold and the list of exhibitors includes many of the leading electrical concerns of the United States and Canada. Much of the remaining space is tentatively disposed of, and there is every reason to believe that everything available will be under contract before December 15.

Chicago's electrical shows have already made their record. In the face of the so-called financial panic of a year ago the show was arranged and carried through to a point of success far beyond the anticipations of the directors, and the exhibitors as a whole declared the show to be greater in general results than any of the preceding expositions of the kind. This was also in the face of the fact that the directors had the courage to carry out a decorative scheme for the Coliseum, which cost in the vicinity of $25,000. The same idea of decorative arrangement will be employed this year.

While this year's show will be representative of every branch of the electrical field, efforts are being made to make the show still more comprehensive and representative as a whole, particularly along the lines of motor-driven working exhibits. Telephone apparatus and devices will be a leading feature, the telephone interests having contracted for considerable space. In the meantime it is hoped that everything new in the electrical world will be on view and that the show will not only be a trade booster but will be of educational value to the general public. Considering the fact that the Electrical Show represents a field which rolled up a volume of business in the United States amounting to $200,000,000 last year, the importance of the exposition may be estimated. Without an exception the exhibitors of a year ago, notwithstanding the business depression of that period, reported sales that more than paid for the time, money and material that they put in the show.

Among the companies that have already contracted for space are the following: Crane Company, Commonwealth Edison Company, Wagner Electric Manufacturing Company, Federal Electric Company, Cutler-Hammer Manufacturing Company, Pyro One-Light Sign Company, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, McDowell-Stocker & Company, Shelton Electric Company, Lindstrom-Smith Company, Western Insulation Company, Murphy Electricity Rectifier Company, National Battery Company, Perfection Vacuum Cleaner Company, Chicago Fuse Wire and Manufacturing Company, Electric Appliance Company, the Excello Arc Lamp Company, Kellogg Switchboard and Supply Company, the Stoltz Electrophone Company, Stromberg-Carlson Telephone Manufacturing Company, Mathias Klein & Sons, Telephony Publishing Company, Manhattan Electrical Supply Company, Fort Wayne Electric Works, *Electrical World,* Benjamin Electric Manufacturing Company, *Electrical Record,* Central Electric Company, International Correspondence Schools, *Popular Mechanics,* McRoy Clay Works, National Electric Lamp Association, Chicago Pneumatic Tool Company, Electrocraft Publishing Company, Robbins & Meyers, Appleton Electric Company, United Pump and Power Company, *Popular Electricity,* Chicago Telephone Company, Swedish-American Telephone Company, Westinghouse Companies, Swedish Vibrator Company, Western Electric Company, Electrical Testing Laboratories, *Electric City,* General Electric Company, North Shore Company, Pacific Electric Heating Company, Electric Storage Battery Company.

Homer E. Niesz, under whose management the last two shows have been great successes, looked after the preliminary work of this year's show, but under the orders of his physicians he has been forced to temporarily abandon work. He returned from the New York show last month, was immediately taken ill and remained in bed three weeks. He is now recuperating at Hot Springs, Ark. In the meantime his work as the head of the show has been taken up by John C. Schayer, who is well and properly known in the electrical field. Mr. Schayer will direct the preparations for the coming show until the return of Mr. Niesz.

Block Signals for Indiana Railroads.

The first railroad convention to be held under the requirements of the Indiana law assembled in the State House at Indianapolis on November 10. A hundred or more delegates, representing the superintendents, operating managers and employes of steam railroads operating in Indiana, were present and took an active part in the proceedings. Union B. Hunt, chairman of the Indiana Railroad Commission, in calling the meeting to order, stated that the object of calling the railroad men together was to make a thorough study of railroad accidents and their causes, and to adopt methods to diminish the number of such accidents. The commission would recommend to the incoming legislature that laws be passed prohibiting the construction of any more grade crossings, and that the expense of separating grade at highway crossings and track elevation may be divided equitably. There are 10,000 unprotected highway crossings in Indiana on which about 100 persons are killed annually.

The commission called the railroad men's attention to a section of the transportation law passed by the last legislature, which provides that after July 1, 1909, the railroads in Indiana must be equipped with and have in operation an approved block system for the control of trains. The commission urged immediate preparation for carrying out this work, but it was stated that an extension of time would be granted where it was shown that an honest endeavor was being made to comply with the law. The commissioners stated that the law does not apply to electric roads, but they would recommend that the incoming legislature so amend the law as to require similar action upon the part of the electric roads.

New Subway Plan for New York City.

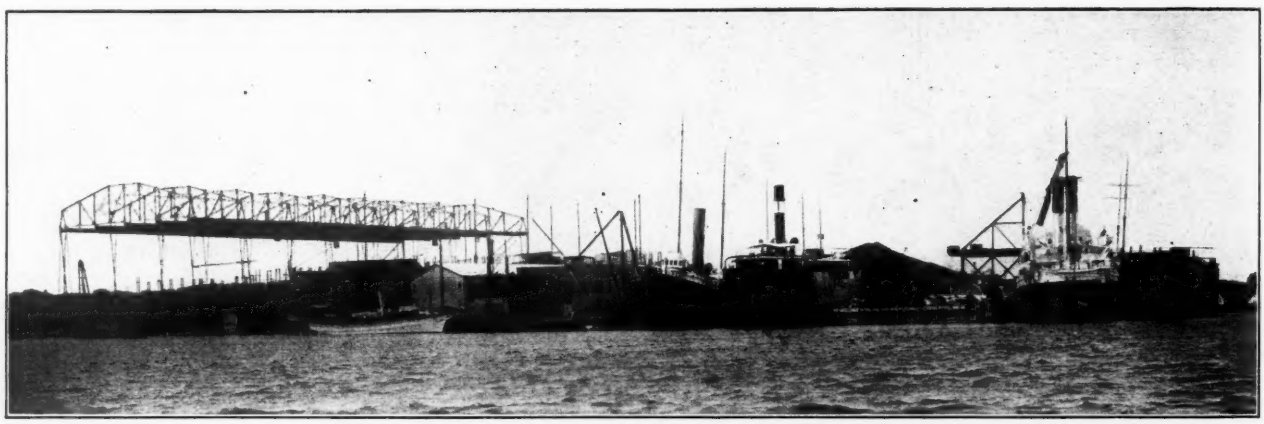
Joseph Caccavajo, an engineer, has submitted to the Public Service Commission his plan for the building of new subways in New York city. The matter was referred to the Committee of the Whole.

The plan, in brief, is that the owners of property along the line of the proposed subway shall form a company, each property owner taking shares in the company to an extent commensurate with his land holdings. It is estimated that a comparatively small sum would have to be subscribed for each lot owned, and that there would be raised by this means a sufficient amount to build and equip a subway system. It would be necessary to amend the law to permit the adoption of Mr. Caccavajo's plan.

The Fore River Ship Building Company's Yard.

The shipyard of the Fore River Ship Building Company, at Quincy, near Boston, Mass., although opened only a few years ago, has already become one of the most important plants on the Atlantic Coast for the construction of large ships, and it would be difficult to find one equipped more completely and embodying more of everything that is latest and best in engineering practice. Less than eight years old, it has already contributed notable additions to the navy of the United States.

Practically every part of a battleship, that most complicated mass of machinery, is constructed within the seventy-eight-acre enclosure. The Fore River shipyard is not the result of slow development. It has arisen almost full-fledged without the usual early stages of experiment and trial. Only the steel and the gray iron castings are brought into the yard in a semi-finished state. Even the electric equipment of the warships is now being manufactured upon the ground; and the engines, both reciprocating and turbine, are built and finished in the shops.



VIEW FROM WATER FRONT OF THE FORE RIVER SHIP BUILDING COMPANY'S YARD, QUINCY, MASS.

The plant is situated upon ground lying along the Weymouth Fore River, really an arm of Boston harbor and only ten miles from the city. The ground has a frontage of one and three-quarter miles. There are fifteen large buildings and a number of smaller ones, furnishing a floor area of nearly twelve acres. Some idea of the magnitude of the works may be gained from the statement that the normal number of men at work is something over 4,000, and that every conceivable labor-saving device is employed. There are about 275 electric motors for driving machine tools, cranes, etc., besides pneumatic ship tools, steam hammers and hydraulic presses.

The most conspicuous structure on the premises is the "ship house," which is merely a huge steel framework for carrying the great cranes, commanding every spot of the area enclosed and having a clear lift of about 100 feet, sufficient to carry material to any part of large vessels lying on the stocks within. This skeleton building is 490 feet long by 325 feet wide and is divided longitudinally into four bays, each equipped with a crane of nearly eighty-foot span. The spreading girders are not intended to support a roof; the form merely exemplifies an economical disposition of material for carrying the cranes.

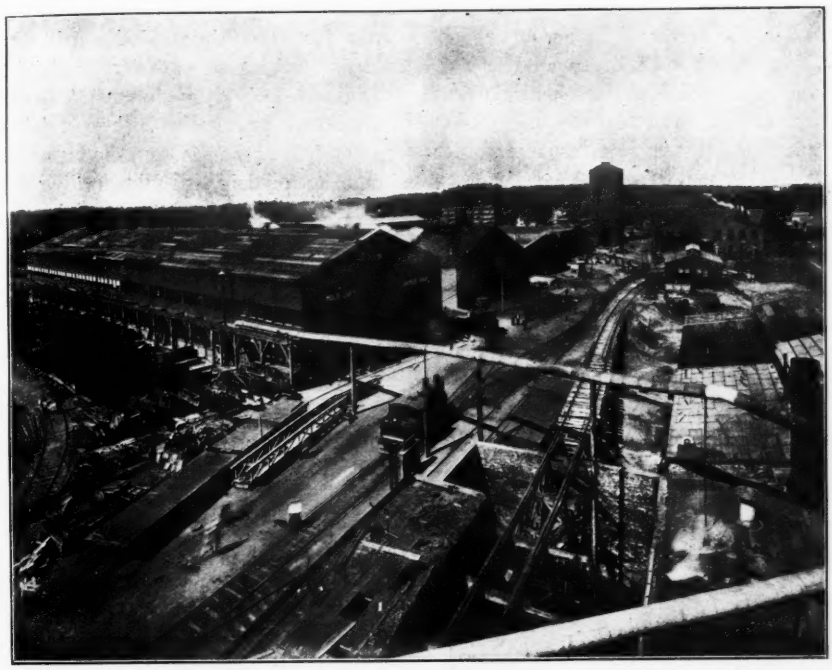
Adjoining the ship house is the ship tool house, which is a large building containing practically every known arrangement for shearing, punching and forming plates and shapes into sections of a ship's frame or skin. The tools in this building are admirably arranged for convenience in handling plates of awkward sizes and shapes. The floor surrounding each punch and shear is as free from obstructions as possible, even all motors and wires being kept out of sight, and every large tool being surmounted by a swinging crane, so that the men have free access to the work in hand and are free to guide it in any direction.

The main machine shop is remarkable for the number of tools of gigantic proportions which it contains. There are huge lathes for turning the crankshafts of the largest battleships, immense boring mills with revolving platforms flush with the floor, great planers large enough to monopolize the entire floor space of an ordinary custom machine shop, and in the side bays smaller tools of all sizes and for all purposes. In one end of the building the great engines of battleships are set up and fitted, later to be taken down and installed in the hulls of the steamers which they are to drive. A portion of the store building is fitted up for the manufacture of electric equipment for the vessels under construction. The pattern shop contains a full equipment of the usual woodworking machinery, the upper floor of the building serving as the mold loft, where the ships' plates are plotted and outlined.

A new blacksmith shop has been added to the plant. It contains some forty fires and a full equipment of hammers. The forge building is the third largest in the United States. Propeller shafts and parts of guns are forced under steam hammers. The annealing plant adjoins the forge. It contains oil-burning heating furnaces and vertical cylindrical annealing tanks for oil baths. There is a saw mill equipped with a large band saw for cutting the timber used in ships, also a brass foundry for casting brass valves and other bronze and brass parts.

The power house is centrally located and is a building 162 feet long by 65 feet wide. There are ten 6 by 16 feet return tubular boilers set in brick and operated at 125 pounds pressure. The boilers are fired by hand, and there are no high chimneys, the Sturtevant system of induced draft being employed. This draft apparatus is, with the exception of the main engines and air compressors, the only steam-driven machinery in the entire yard. For driving the machinery of the plant there is one 350-kilowatt generator

driven by a horizontal steam turbine; one 300-kilowatt generator direct-connected to a compound condensing engine; and one 200-kilowatt generator also driven by an engine. For operating pneumatic hammers, drills, calkers, etc., used in ship work, there are two compressors, one having a capacity of 5,000 cubic feet per minute and the other delivering 1,000 cubic feet, both being operated by cross-compound engines. All the apparatus of the power house is of very simple construction, only one kind of current being generated for all classes of service—direct current at 240 volts. Current is generated for about 275 motors, varying in size from one-fourth to 100 horsepower, the major portion being supplied by the Allis-Chalmers Company, and also for about 4,000 incandescent lamps and 350 arc lamps.



THE YARD RAILWAY, MOLD LOFT AND BASIN, FORE RIVER SHOP BUILDING COMPANY, QUINCY, MASS.

VIEW IN SHOP OF FORE RIVER SHIP BUILDING COMPANY, QUINCY, MASS.

About seventy-five per cent of the motors are direct-coupled to the tools which they drive. Some of the remainder are belted, and in one or two cases counter-belted to obtain a high speed, this practice being almost entirely confined to woodworking tools requiring a different method of power application. There are a number of special motor-driven tools designed to facilitate ship-building operations. One of these is a counter-sinking machine, consisting of a motor geared to a drill stock which holds the tool, the whole being mounted on a hand barrow, so that the entire apparatus can be rolled over a plate placed in a horizontal position and the tool brought to its work by merely pressing down in the proper positions. While the aggregate load of all the motors in the yard is not far from 3,800 horsepower, the average load upon the generators is only about 2,400 amperes for both power and lighting, or about 800 horsepower. The load varies according to the number of tools actually in operation or in idleness, but the figures here given are a fair illustration of the economy of the system of power distribution and subdivision employed in the yard.

One of the most interesting features of the electric equipment of this shipyard is the system for speed variations. This is the Ward Leonard multiple-voltage system. The generator is operated on the two-wire plan, supplying the highest voltage, 240 volts, and on this voltage are operated all the constant speed motors, the crane motors and the lighting system of the yard. For variations of speed this voltage is divided into three by means of a balancer set located in the engine room and consisting of three similar machines mounted upon a common base. This enables pressures of sixty, eighty and 110 volts to be carried between the various pairs of the four wires. By proper combinations a number of pressures may be obtained, and, with the aid of a small range of shunt field regulation, a large range of motor speeds, the highest of which is six and one-half times the lowest, may be secured.

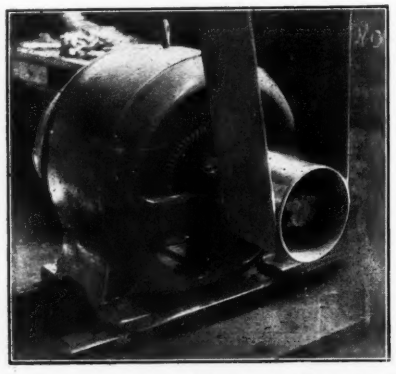
The current is distributed to the various buildings by means of about 1,000 feet of subway and nearly a mile of pole line. The average center of distribution in each building is about 500 feet from the power-house switchboard, and each shop has its own set of mains coming up through the floor to a distributing board and the feeders are led in various directions to the individual tools. The distributing center of the ship tool shop is

placed in a gallery above the main floor, where the control apparatus of the various heavy tools is also located. One attendant standing in a position whence he can see the operations going on in any part of the shop controls all the ma- travel. There is an eight-horsepower parts, such as controllers and regulators, from the machines, where in this particular shop they would be especially liable to injury, to a place of safety. In this shop all circuits are run under the floor and brought to the machines through steel conduits, and there are no exposed wires anywhere in the neighborhood of the machines. In the subway the circuits are run in rubber-covered cables, manufactured by the Standard Underground Cable Company. These are simply fastened to wooden strips, which give sufficient insulation with the low voltage used and the dry atmosphere of the subway. At the center of distribution in the buildings the line is brought up in enameled "electro-duct" tubing, and there the main fuses and switches of the machines are placed.

To the casual visitor in the Fore River shipyard no one feature is more interesting than the great variety and number of electric traveling cranes used to facilitate the handling of material. The great crane which reaches every portion of the plate yard adjoining the steel tool shop is the largest of its kind in the world. It has a span of 175 feet and travels over 1,000 feet of track. The long driving axle is operated by a motor placed in the center of the span, and the lift has a capacity of about five tons. For placing equipment in ships already afloat there are six or more large cantilever cranes and one big folding jib gantry crane, which travels the entire length of the 1,000-foot fitting-out pier. This structure, which is conspicuous in all views of the yard, has no less than seven Allis-Chalmers electric motors. There are three hoist motors: One twenty-five-ton, another seventy-five ton, and one for the ten-ton falls at the end of the boom. The remaining motors are employed, one for crane travel, two for trolley travel and one for hoisting the boom.

In the large machine shop there are three great cranes, two of twenty-five-ton and one of fifty-ton capacity and about eighty-foot span and 520-foot travel. In the ship house are four, having a runway the entire length of the structure, that are capable of lifting a five-ton weight 100 feet vertically and depositing it at any point within the four sections. In the forge and annealing plants one seventy-five-ton and one twenty-five-ton cranes handle the immense ingots, crankshafts and gun parts with ease. Every shop has some form of overhead lifting apparatus wherever there is an opportunity to save time and muscular energy. In fact, the yard is the best possible field for the student interested in the evolution of the workingman from a mere source of energy to the active intelligence which directs and controls the energy developed by machines. It is difficult to find in the entire plant an example of "labor" in the old sense of the word, the mere play of human muscles.

All the large machine tools in which a variation of speed would be desirable are operated by Allis-Chalmers motors on the four-wire multiple-voltage system. In the main machine shop there is one of thirty



TYPE OF ALLIS-CHALMERS MOTOR USED BY FORE RIVER SHIP BUILDING COMPANY.

horsepower mounted upon a 120-inch Niles-Bement-Pond lathe of 108-inch swing; one of twelve and one-half horsepower upon a seventy-two-inch lathe of the same make; four of eighteen horsepower operating sixty-inch Fitchburg lathes; two of twenty-four horsepower driving forty-eight-inch Fitchburg roughing lathes; and four of eight horsepower operating one fifty-inch, two forty-eight-inch and one thirty-six-inch lathe, all of Fitchburg make. In the same shop one fifty-horsepower motor drives a sixteen-foot Niles-Bement-Pond boring mill; one of twenty-four horsepower is on a 120-inch boring mill of the same make; one of fifteen horsepower on a seventy-two-inch Pond boring mill; one of twelve horsepower on a sixty-inch Niles boring mill; one of nine horsepower drives a fifty-inch Niles boring mill, and one of twenty-five horsepower operates a ten-foot boring mill. There are two of four horsepower each on radial drills and two of forty-five horsepower on crank-turning lathes—an interesting machine on which the great cranks used in large ships are braced against distortion by gravity and the cutting-tool travel. There is an eight-horsepower motor for a multiple spindle drill and another of the same capacity for driving an eighteen-inch Niles slotter. A second Niles slotter, twenty-five inches, is driven by an eighteen-horsepower motor and a similar motor drives a Niles milling machine. A Newton cold saw is driven by an eight-horsepower motor. This shop contains a multiplicity of other tools and motors. Those here enumerated comprise only those operated on the four-wire multiple-voltage system.

In the ship tool shop the following machines and motors are operated on the same system: One twenty-four horsepower driving an angle beveling machine; two of four horsepower, each on double-ended shapers; and one of one-and-one-half horsepower to operate a testing machine for bending and breaking strains. In the storehouse is a four-horsepower motor for operating a Newton cold saw. In the electric machine shop two motors of four horsepower drive a sixteen-inch lathe and an American turret lathe, respectively. There is one of three horsepower to drive a thirty-inch drill press; one of one-half horsepower on another drill press, and a second motor of one-half horsepower for operating a coil-winding machine designed on the premises.

Boston Elevated to Increase Capital Stock.

At a special meeting of the Boston Elevated Railway Company it was voted to authorize directors to issue $6,650,000 capital stock at $110 per share to construct and equip the proposed Cambridge subway.

Before passing this vote, however, stockholders had previously authorized the rescinding of the vote of April 13, 1907, which authorized the issuance of $8,000,000 capital stock at a price to be determined by the railroad commissioners.

The $6,650,000 new stock will bring the total stock authorized up to $19,950,000.

The company has petitioned the railroad commission for its approval of the proposed increase.

The issuance of $6,650,000 of new capital stock will give Boston Elevated stockholders the right to subscribe for one new share for each two shares now owned.

Resolutions on the Death of Charles E. Trump.

At a special meeting of the Electrical Trades Association of Philadelphia, Pa., resolutions were adopted on the sudden death of Charles E. Trump, ex-president of the association, which occurred when he reached home shortly after attending the annual meeting of the organization, which was held at the Manufacturers' Club on the evening of November 5. The resolutions were accompanied by a letter from the retiring president, Charles M. Wilkins, addressed to C. Norman Trump, the deceased's son. Mr. Wilkins' letter was as follows:

The sudden death of your beloved father is a great shock to his friends in the Electrical Trades Association, of which he was a member and officer since the organization now more than thirteen years ago. The fact that he attended the annual meeting last evening, when he greeted his friends with cordiality, and his bright and cheerful spirit was so noticeable, makes it difficult for us to realize that he has been called away.

The members of the executive committee of the association have requested me, in their behalf, to convey to you and the members of his family their heartfelt sympathy in this hour of affliction. Your father was a man whom to know was to love, and his loss will be keenly felt by the members of the association and the electrical trade in general. As president for twelve years he endeared himself to his associates for the sterling qualities of his character; in all questions involving its welfare his judgment was sound, and if he erred at all it was in leaning toward the charitable side to the end that injustice should be done to no man.

A copy of a minute adopted by the executive committee, which will be suitably engrossed and sent later, is enclosed herewith, and it but feebly expresses the sense of loss and appreciation of regard for your father.

The resolutions adopted by the association at its special meeting on November 6 were as follows:

The members of the executive committee of the Electrical Trades Association of Philadelphia learn with great sorrow of the death of their former president and associate, Mr. Charles E. Trump.

Mr. Trump served the Electrical Trades Association as a member of its executive committee and president for twelve years, retiring one year ago. At the annual meeting, held on the evening of November 5, 1908, which Mr. Trump attended, he was again honored by election as a member of the executive committee. Mr. Trump's sterling character gained for him the respect and esteem of all with whom he came in contact, and as a mark of our love and regard we unanimously adopt the following RESOLUTIONS:

RESOLVED, That we bow to the will of a Supreme Power, and while grateful for the useful life vouchsafed to our late associate we are yet full of sorrow in our bereavement;

RESOLVED, That we hereby bear witness to the noble manhood of Mr. Trump, whose conception of duty was of the highest, and his aim in life was to be just to all men;

RESOLVED, That we tender our sympathy to the family in this hour of affliction, and that the past and present members of the committee attend the funeral in a body; and, further,

RESOLVED, That a copy of these resolutions be suitably engrossed and sent to his family, and a minute of the same be entered upon the records of the association.

Effect of the Purity of Water on Its Industrial Use.

In connection with an investigation of the quality of surface and underground waters in different parts of the United States, R. B. Dole, of the United States Geological Survey, has made an estimate of the saving that may be accomplished in the production cost of steam by use of a plant for softening water. He says:

"Analyses of Maumee River water, selected as a typical hard water, show that it contains incrusting solids amounting to 360 parts per million, 105 parts of which are suspended mud, etc., and the rest carbonate and sulphate of calcium, with some magnesium, a combination which inevitably forms a hard scale in boilers. If this water were used in a 1,000-horsepower boiler, 100,000 gallons daily would be required. In six working days 1,800 pounds of scale would be deposited in the boiler. In the following figures, the first set estimates the probable excess cost due to the use of bad water, while the second estimates the probable cost after purifying the water. The inference to be drawn from the difference in dollars and cents is obvious:

Cost with use of hard water.

Average coal consumption for 1,000-horsepower boiler, 48 tons a day. 48 tons of coal at $1.50 is $72. Estimated saving in fuel on this water due to use of treated water is 5 per cent. Five per cent of $72 is $3.60 per day, or, for 300 working days	$1,080.00
Cleaning boiler, at $8 per week	416.00
Repairs for tubes, etc	200.00
Boiler compounds	250.00
Coal for raising steam after cleaning, 104 tons at $1.50	156.00
Seven and one-half per cent depreciation on boiler plant costing $15,000	1,125.00
Total	$3,227.00

Cost with use of softened water.

Ten per cent interest and depreciation on softening plant costing $3,500	$ 350.00
Boiler repairs	50.00
Chemicals at 1 per cent. per 1,000 gallons	300.00
Coal for raising steam after cleaning, 16 tons at $1.50	24.00
Five per cent depreciation on boiler plant costing $15,000	750.00
Total	$1,474.00

"The total saving in a single year is, therefore, $1,753, practically half the cost of installing a softening plant."

Remote-Control by Electric Waves.

An interesting apparatus recently constructed by two engineers of Nuremberg, Germany, Messrs. Wirth and Beck, allows, through the medium of electric waves, any levers to be thrown forward or backward, upward or downward, steering wheels or cocks to be turned in a right-hand or left-hand direction and electrical apparatus to be thrown in or out of circuit. In fact, it provides a means of controlling the most varied machines from a distance without there being any material connection between them and the operator. The idea of using Hertzian waves is, of course, not new, says the London *Times* Engineering Supplement.

At demonstrations recently made of this apparatus before the Nuremberg Society of Natural History and other societies the experimental table contained a plant for receiving electric waves similar to those used for wireless telegraphy, connected to the radio-telegraphic controller and the accessory apparatus actuated by the latter.

In another room was installed a radio-telegraphic sending apparatus susceptible of being tuned up to the receiver, and actuated by electromagnetic waves from the apparatus installed on the experimental table. No connecting wires were provided between the sending and receiving apparatus.

Whenever a lever connected with the sending apparatus was adjusted to various positions the apparatus corresponding to these was actuated. A number of electric lamps were thus lighted in any order desired, or in groups, and a small steam-engine was started, reversed or stopped, while electric bells and motors were actuated, powder mines exploded and a revolver fired rapidly.

While torpedoes can be employed so far only over small distances, it is claimed that it will now be feasible to provide them with a far greater driving power, thus directing them toward their goal with safety and from many miles distance.

Land and sea mines have frequently been exploded by electricity transmitted by extensive cables between the operator and each of the mines. The same operation can now be effected through electric waves, that is, by wireless means, provision being made so that only the mine in question is exploded. This firing of mines through electric waves is likely to be adopted advantageously by several branches of industrial activity.

BOOK REVIEWS.

The four books referred to below belong to the well-known series of compact handbooks on various branches of technology published by Dr. Max Jänecke of Hanover, Germany. In each book the elementary principles underlying the subject are first discussed with the aid of simple mathematics only. Practical applications of these principles are then considered. While the Continental practice is mostly dealt with, there is enough of universal interest in each of the volumes to make them of value to German readers anywhere.

"Die Elektrizität auf den Dampfschiffen" ("Electricity on Steamships"). E. Bohnenstengel. Third edition. 124 pages. 4½ by 7 inches. 117 illustrations. Price, in paper, 1.8 marks; in cloth, 2.2 marks.

The aim of this book is to make the captain and other officers familiar with the operation of the electrical devices they have to deal with. After a short introduction on the theoretical foundations the author treats of dynamo-electric machinery, storage batteries, lamps, auxiliary apparatus, distribution systems, conductors, annunciators, telephones, signaling devices, wireless telegraphy and telephony.

"Die Elektrizität als Warmequelle" ("Electricity as a Source of Heat"). Dr. Friedrich Schoenbeck. 104 pages. 53 illustrations. Price, in paper, 1.6 marks; in cloth, 2 marks.

In this book the subject of electric heating is dealt with concisely from all points of view. The laws of electrically developed heat and its units are clearly explained and defined, as is also the calculation of resistance conductors. The various methods of converting electrical energy to heat are described. Applications of electric heating are then considered for cooking and heating in the home and shop, heating of rooms, electric furnaces and their electrochemical products, laboratory apparatus, measuring instruments, electric welding and soldering, ignition, medical and other miscellaneous purposes.

"Handbuch fur den Bau und die Instandhaltung der Oberleitungsanlagen Elektrischer Bahnen" ("Handbook on the Construction and Maintenance of Overhead Line Equipment of Electric Railways"). Arthur Ertel. 336 pages. 294 illustrations. Price, in paper, 4.2 marks; in cloth, 5 marks.

This is a comprehensive compendium on trolley-line construction. The planning and calculation of the working conductor and feeder systems are explained and illustrated. Various types of overhead equipment are described and their construction considered in detail. Special attention is given the layout of curves, crossovers and crossings, the provision for joint use of poles for telegraph or telephone service, catenary construction for high-speed service, trolley construction in tunnels and on bridges, signaling systems, sectionalizing, etc. The maintenance is considered under the sub-heads of periodical inspection, breakdowns in service, repair wagon and tools, regulations. The book is a valuable one for railway engineers, superintendents and foremen.

"Ruhende Umformer" ("Stationary Transformers"). Victor Bondi. 144 pages. 104 illustrations. Price, in paper, 2 marks; in cloth, 2.2 marks.

The fundamental problems relating to transformers form the subject of this book. An excellent idea of its scope may be obtained from the main topics considered, which are the magnetic field, generation of electromotive force, single-phase and polyphase currents, properties of alternating currents, characteristics of single-phase and of polyphase transformers, design and construction of transformers, connections, special transformers, installation of transformers.

"How to Build up Furnace Efficiency." Joseph W. Hays. Chicago. Published by the author. 48 pages. 3½ by 6¼ inches. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for 50 cents.

In this handy little book the author treats of the most vital problems in boiler-room practice. Methods of firing and draft regulations are discussed in detail as well as all points bearing on coal economy. A careful study of flue gases is made and the author strongly recommends a systematic analysis of the flue gases, preferably with a hand instrument and automatic sampling vessel. The style of the author is so clear that even an ordinary fireman will find much of profit in this book, if he is interested in its title.

Success of Inspection Work.

The Fire Underwriters' committee on fire protection engineering has made a report to companies on the recent meeting of the Western Association of Electrical Inspectors, held in Chicago, October 20, 21 and 22. It is reported that interest in the work of the association has increased, and members are continuing to exhibit a broader conception of the electrical hazard and are seeking the best method of accomplishing its removal. The principal difficulty experienced has been where individual inspectors disagree with existing rules, and when feasible such differences of opinion are made the subject of reports by special committees which are subsequently discussed and the result submitted to the electrical committee of the Underwriters' National Electrical Association, in the form of proposed amendments to the National Electrical Code. The general tendency has been to raise the installation standard rather than lower it. More care is being exercised in discriminating against unapproved materials and devices; members are becoming more familiar with the fire dangers existing in defective electrical fittings through tests carried on during the meetings held in Chicago, these experiments proving the most effective means of impressing upon inspectors the need for careful scrutiny of this detail of the electrical equipment. That the association is meeting, to some extent, the every-day needs of the electrical inspector is evidenced by the large number of applications for membership received from inspectors located in Pacific Coast territory and Canada. The indications are that the work of the organization will be vigorously pressed during the coming year.

Proposed Chicago Building at Alaska-Yukon-Pacific Exposition.

An option for an advantageous site for a Chicago building at the Alaska-Yukon-Pacific Exposition, to be held at Seattle, Wash., in 1909, has been secured by the Chicago Association of Commerce and a special committee has begun the preliminary work of ascertaining the representation desired by merchants of the city.

The building and its maintenance as planned will cost $60,000, although the structure can be enlarged if this scale is found inadequate. It will contain reception rooms, offices and a big lecture room. Only about $25,000, it is believed, will be needed for the building, and the remaining sum is to be devoted to a publicity campaign.

The impossibility of representing even a small per cent of Chicago's industries by an actual display of goods is admitted. Instead, the committee has outlined the plan of installing a lecture platform and an all-day series of moving pictures and stereopticon slides showing how Chicago goods are made, with a lecture demonstrating their qualities.

Frederick Bode, president of Gage Brothers, is chairman of the committee which has the enterprise in charge.

The exposition opens June 1, 1909, and closes October 16.

Tripod for Lighting Fixtures.

By the invention of new devices and the improvement of old appliances the work of wiring a building for electric lights or power has been greatly facilitated and its character decidedly improved. A simple device of this kind has been invented by Edwin A. Emery, of Galva, Ill. It is a tripod for supporting electric-light fixtures, and was patented a month ago. It is designed to lessen the labor of hanging such fixtures and to provide for their ready adjustment, so that they will hang plumb.

The accompanying drawings illustrate the construction of this device. Fig. 1 is an elevation of an electrolier or chandelier secured to a ceiling by one of the new tripods, the canopy being withdrawn to reveal the tripod; Fig. 2 is a detailed plan view of the tripod; and Fig. 3 is a central sectional view thereof. In these drawings, 1 designates the stem of the electrolier and 2 the canopy for covering the tripod 3. The latter is made in two parts, one comprising a plate 3^a having curved arms 3^b converging toward each other and the other consisting of a smaller plate 3^c having curved diverging arms 3^d spaced similarly to the arms of the first part. The arms 3^d normally engage the inner faces of the arms 3^b, and are secured thereto by screws. The passages 5 for these screws in the arms 3^b are larger than the shanks of the screws for the purpose of adjustment. The plate 3^c has a screw-threaded passage 6 through it to receive the stem of the electrolier.

Practice has shown that when a fixture is secured to a plastered ceiling it will nearly always be out of plumb, owing to unevenness in the surface of the plaster. When the ordinary one-piece tripod is used the only way to remedy this is to loosen the screws holding the tripod to the ceiling and wedge it down with washers or pieces of cardboard or other material. This requires time, and at best gives only a botch job when finished. When Mr. Emery's tripod is used, as soon as the fixture is secured to the ceiling, the adjusting screws 4 may be loosened to permit the fixture to plumb itself or be plumbed, after which the screws may be tightened, making a good, firm job.

If desired, the upper or main part of the tripod may be screwed to the ceiling or wall first, and the electrolier or bracket having the smaller part of the tripod screwed upon it, may have its arms inserted between those of the main part and turned until the screws 4 can be put in and tightened. This also makes it convenient if the fixture has to be taken down for repairs, as none of the screws that hold it to the ceiling have to be disturbed.

It has been noticed with the old-style tripod that the wiremen fasten the fixture to it before installing it. When this is done the starting of the screws through the plaster will cause it to crumble and fall down within the canopy, which has

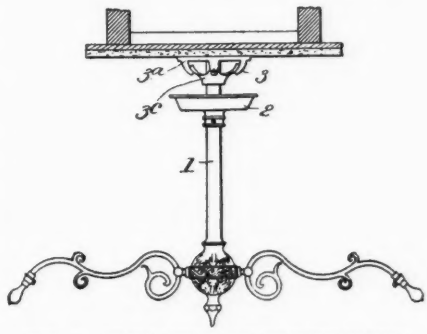
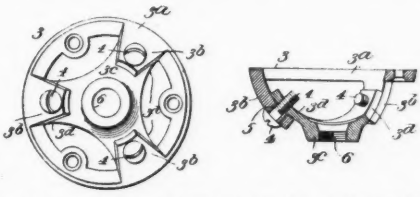


FIG. 1.—ELEVATION OF ELECTROLIER.

been dropped down on the stem, as illustrated, for instance, in Fig. 1, to permit access to the screws. Then, when the canopy is slipped up into place, the plaster will lodge between the canopy and stem and scratch the casing of the latter, removing the lacquer and causing it soon to tarnish. By employing this tripod



FIGS. 2 AND 3.—DETAIL PLAN AND CENTRAL SECTION OF TRIPOD.

and screwing the upper or main part on first, this can be avoided. Of course, the old style of tripod can be put up first, but in screwing the stem of the fixture into it at least six turns are required, and the wires in the stem are liable to become short-circuited.

Central Electric Railway Association.

The regular bi-monthly meeting of the Central Electric Railway Association, embracing the interurban lines of Indiana and Ohio, was held at Lima, Ohio, November 18. The meeting was marked by excellent attendance and interest, and the subject taken up brought out a more general discussion than has characterized the meetings heretofore. F. T. Carpenter, president of the association, after congratulating the members upon the large attendance, introduced Mayor Becker of Lima, who graciously welcomed the members of the association to the city.

The first topic of the session was "The Possibilities of Electric Lines Hauling United States Mail in Competition with Steam Roads." A number of members who discussed the question testified that from experience in carrying mail upon their lines the proposition had not proved a financial success. It was asserted, however, that the electric lines have not yet had sufficient experience in carrying the mail to decide just what the possibilities of such service might bring forth.

The second subject, "The Claim Department," was presented in an address by Frank Tallmadge, president of the Frank Tallmadge Company of Columbus, Ohio. The definition of what a claim department should be constituted the basis of Mr. Tallmadge's address. He urged that it be properly organized and systematically developed and operated.

"Railroad Crossings" was the subject of a paper presented by W. C. Sparks, superintendent of track and roadway for the Indiana Union Traction Company, Anderson, Ind. The increased weight of interurban cars has caused the engineering department no little trouble to maintain crossings under the constant hammering of heavy locomotives and cars, and engineers and manufacturers have been called upon to build a crossing that will stand up under a service of this sort. Mr. Sparks described the two types of railroad crossings in use and told how they should be constructed and the best plan for keeping them in repair.

The concluding subject of the programme was that of a general discussion of the "Effect of Financial Depression on Earnings of Interurban Roads and Lessons to Be Learned from Experiences of the Last Twelve Months." This discussion took the form of an experience meeting, and the reports varied largely with the local conditions met by each speaker. The extent of the depression during the past few months was not discouraging, and the future, as expressed by those participating in the discussion, is held to be quite optimistic. Great results are in store for the development and increasing operation of electric railways in this country, it was said.

After authorizing the new mileage book to be placed in commission over the electric lines of Ohio and Indiana after January 1, the association set its next meeting for Indianapolis, January 28, and adjourned. S.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

EFFECT OF CONNECTING ELECTROLYTIC DETECTORS IN SERIES AND IN PARALLEL.

This is a communication by M. Jegou to the French Academy of Science. In his experiments he made use of electrolytic detectors with interchangeable anode points, the sensitiveness of which was perfectly well known. The tests made showed clearly that the connection of two or more electrolytic detectors in series is always detrimental to their sensitiveness, a group of detectors so connected being considerably less sensitive than the most delicate one of the group. Care was taken in these experiments to choose the current source, so that the critical tension was always applied, which naturally varies considerably with the number of detectors joined in series.

The investigation of the parallel grouping of the detectors is of much greater interest, as it was shown that the most sensitive one determined the sensitiveness of the group. In this instance the critical tension remained the same. It would seem that the grouping of two or more electrolytic receivers in parallel might be employed with advantage in practice, as a much greater constancy in the sensitiveness of the receiver may in this way be attained: for if the sensitiveness of one of the detectors should accidentally be lowered the general sensitiveness of the receiver will not be at all affected in view of the property mentioned, and in order that this condition may be permanent it is sufficient for only one of the group of detectors to be intact. It is assumed, of course, that care has been taken to use detectors of nearly equal sensitiveness in the group. Furthermore, the connection in parallel has the advantage that the electrolytic points are more seldom burned by powerful waves, emitted by the station itself, for instance. The explanation of the phenomenon seems to be as follows: When the effects on the receiver are extremely feeble, only the most sensitive one of the group of detectors will operate, but when the effects are stronger, the others will operate at the same time. The energy is then divided among the various points of the receivers, and is sufficiently weakened to prevent the burning of the points in many instances.—*Translated and abstracted from La Lumiere Electrique (Paris), October 24.*

THE CONFERENCE ON UNITS AND STANDARDS.

Prof. S. P. Thompson, in a critical résumé of the work of the International Conference on Electrical Units and Standards recently held in London, calls attention to the discrepancies that it was hoped this gathering would eliminate. Thus, while the Chicago Electrical Congress of 1893 had secured international agreement on the definitions of the ohm, ampere and volt, and these units had been generally adopted, some countries had also legally adopted concrete standards not absolutely consistent with the defined units. The real object of calling the conference was therefore to extricate several countries from the difficulties created (a) by the adoption of all three units, instead of two of them, as equally primary; (b) by the confusion between units and standards, and (c) by the discovery of the error of one-tenth of one per cent in the voltage of the Clark cell. In tracing the history of the ohm it is interesting to note that from determinations of the specific resistance of mercury in terms of the absolute ohm made by Lord Rayleigh and others with an accuracy of three or four in 10,000, the length of a column having the prescribed cross-section, mass and resistance is nearer to 106.26, or 106.27 centimetres, instead of 106.3 as adopted in 1893. Mercury columns can now be set up that will not differ from each other by more than a few parts in 100,000. The accuracy with which two resistances can be compared with one another is now far higher than even this, being within three or four parts in 10,000,000. It was expected, therefore, that the International Conference would ascertain with accuracy what the length of the representative column really is, whether 106.26, or 106.27, or 106.3. Until this value should be ascertained by experiments of a refinement comparable to those made in the other lines of advance, any fixing of the final figure could but be arbitrary and not scientific. The adoption of the definition of the ohm as the unit of resistance "which has the value of 1,000,000,000 in terms of the centimetre and second," and then giving its length as 106.300 centimetres, is certainly not consistent, for if the figure 3 is in doubt, what is the use of adding the two zeros.—*Abstracted from the Times Engineering Supplement (London), October 28.*

A CONTRIBUTION TO THE KNOWLEDGE OF THE MERCURY-VAPOR ARC AS A RECTIFIER.

In the rectifier bearing the name of Cooper Hewitt the rectified current flows through the arc in the direction from the mercury to the iron electrode; if the iron electrode is replaced by one of carbon, the rectified current retains the same direction. In experiments made by the author, Dr. Johann Sahulka, at the Electrotechnical Institute in Vienna, in 1894, with the mercury-vapor-light rectifier the alternating-current arc was formed in free air between iron or carbon as one electrode and mercury as the other, and the current flowed in exactly the opposite direction from that which it takes in the Hewitt rectifier, namely, from iron or carbon to mercury. In the Hewitt rectifier the arc is formed in an evacuated space. Doctor Sahulka states that this peculiar influence of air pressure on the behavior of the rectifier is nowhere mentioned in technical literature, and for this reason he calls attention to it and to his work on the effect of the mercury-vapor arc as a rectifier, which was published in the *Zeitschrift fuer Elektrotechnik* in 1894. He continues: "I formed the arc by dipping an iron or carbon electrode into mercury contained in a porcelain vessel and then lifting it a little. The escape of the resulting mercury vapor was prevented by a protecting case with glass walls. In consequence of the great heat an incandescent drop formed at the end of the iron electrode, which would frequently fall off and cause disturbances in the measurements; therefore I replaced the iron rod by a carbon electrode. In tests made between a carbon electrode eleven millimeters in diameter and mercury in free air, with an alternating current of 105 volts and forty-two periods, the rectified current amounted to about sixty per cent of the alternating current. The reason that in my experiments a rec-

tified current is obtained which flows in a direction opposite to that in the Cooper Hewitt rectifier I explain as follows: It is well known that an arc can exist only when the vicinity of the cathode is sufficiently conducting; this requirement does not need to be fulfilled for the anode. In my experiments an incandescent drop forms at the end of the iron electrode, which, when the current sinks to zero, can give off its heat only with difficulty, as it is surrounded by a gaseous medium on all sides. The drop therefore remains at a very high temperature when the current value is zero and sends out conducting vapors, so that its vicinity always remains a good conductor. The mercury is heated to the boiling point when the current reaches its maximum value and sends out conducting vapors; but the heated spot cools very rapidly when the current sinks to zero, as it can easily give off its heat to the uncooled portion of the mercury and the vaporization ceases in consequence of the cooling. When the alternating current flows in the direction from the mercury to the iron electrode it can pass easily on account of the good conducting property of the vicinity of the latter. The mercury is then also vaporized and a heavy current is able to come into existence. But if the current is flowing in the opposite direction it can pass only with difficulty, or eventually not at all, on account of the low conductivity of the cooled mercury electrode. In my experiments, therefore, the rectified current has to flow in the direction from mercury to iron. The conditions remain the same, when the iron electrode is replaced by one of carbon, as the point of the carbon becomes incandescent upon the formation of the arc and cools very little on account of its poor conductivity. The Cooper Hewitt rectifier consists of an evacuated vessel which is provided with a mercury and two iron electrodes. The latter are connected to the secondary terminals of a transformer, while the mercury electrode is joined to the center of the transformer winding through a resistance. In consequence of the good conductivity of the gaseous medium the arc spreads through the entire vessel and the solid electrode is, therefore, heated very little, while the mercury is easily vaporized on account of the low pressure in the vessel, and its vicinity has a better conductivity than that of the solid electrode. If the rectifying effect of the iron-mercury vapor arc were examined in differently evacuated spaces the result would probably be that the reversal of the rectified current takes place when the conductivity of the medium has been so far reduced that the so-called thread-like arc replaces that occupying the entire vessel. But in this case the rectifier can operate only when an incandescent drop has formed at the iron electrode, the vapors from which make its vicinity conducting.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), October 22.*

A DIRECT AND ALTERNATING-CURRENT GENERATING GROUP FOR AN ELECTRIC RAILWAY.

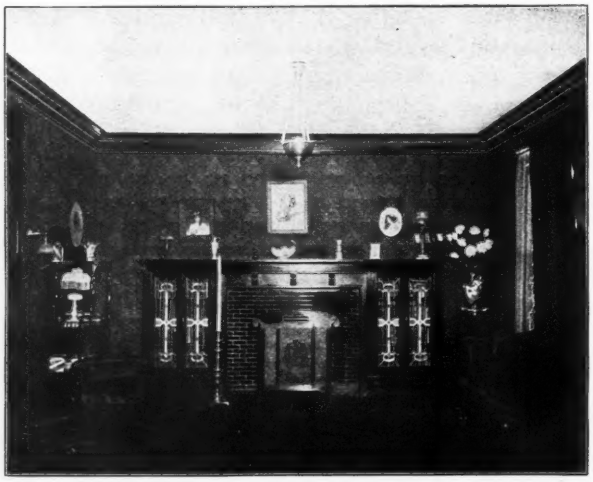
A direct and alternating-current generating group, which was exhibited at the recent Exposition in Marseilles, possesses some original and interesting features. The set comprises a hydraulic turbine coupled to a double-current generator, and is intended to supply current for the Villefranche and Bourg-Madame electric railway in the Eastern Pyrenees. The turbine is built to operate under a head of 400 meters and furnish about 1,100 horsepower at a normal speed of 575 revolutions per minute. Its shaft is horizontal and the buckets are of the Pelton type, although of a special construction. They have the shape of spoons and are all coupled together in a crown bolted to the center disk. Two rings shrunk hot around the buckets insure resistance against centrifugal force. The water enters the turbine in a vertical direction from below. The bronze nozzle is equipped with a hydraulically balanced regulating tongue, which is actuated by a speed governor of great precision operated under oil pressure. The characteristic feature of this governor is that there is no permanent water pressure in the auxiliary motor, but only at the instant when regulation of the angular speed takes place, and its value is always proportionate to the resistance furnished by the turbine buckets. The regulation insured by this apparatus and a 5,000-kilogramme flywheel is so perfect that the speed variation does not exceed four per cent from the normal under a change of load up to fifty per cent. The turbine is provided with a pressure regulator, which opens a compensating orifice in a branch pipe. All the inlet valves of the turbine and pressure regulator are located in the basement in order to avoid any discharge of water in the machine hall, and are operated by auxiliary hydraulic motors controlled electrically from the switchboard. The direct and alternating-current generator is coupled to the turbine by an elastic sleeve. It is designed to furnish direct current at 800 to 850 volts, or three-phase current at 600 volts and twenty-five periods a second. Though rated at 850 kilowatts, it is capable of withstanding momentary overloads of fifty to sixty per cent. The machine is of the stationary inductor type, drum wound, built up of sheets of high permeability and a low coefficient of hysteresis, reducing the losses by heating. The sheets are insulated by paper to prevent the formation of Foucault currents. The armature winding consists of carefully insulated electrolytic copper bars shaped on a form so as to be interchangeable. The direct-current commutator is made of copper segments insulated by micanite. The brushes are of carbon and are sufficient in number to withstand the heavy overloads without undue heating. Auxiliary poles mounted in series with the armature insure a perfect and sparkless commutation with the brushes in a fixed position. A resistance connected in parallel with the winding of these auxiliary poles permits the regulation of the current flowing through it to the proper value. The polyphase current collector consists of six bronze rings, each connected to a fixed point of the armature; the brushes are of copper sheet. The cast-steel inductor has eight main pole projections of thin iron sheets and eight auxiliary poles of cast steel. The poles carry a shunt and a series winding. The turns and size of the copper in the series winding are so chosen that the tension of the machine rises from 800 to 850 volts between no load and full load. The group forms part of the equipment of the abovementioned railway power station, which contains four identical generating sets and also transformers giving a secondary pressure of 20,000 volts. A high-tension transmission line feeds five substations, in which step-down transformers and rotary converters are installed for furnishing direct current of 800 to 850 volts to the third rail. The use of double-current generators at the central station has made it possible to dispense with one substation, since the generators can also feed the third rail direct. A constant pressure at the various feed points for the third rail is insured by a suitable relation between the compound excitation of the rotary converters and the self-induction of the transformers and transmission line.—*Translated and abstracted from L'Industrie Electrique (Paris), October 25.*

INDUSTRIAL SECTION

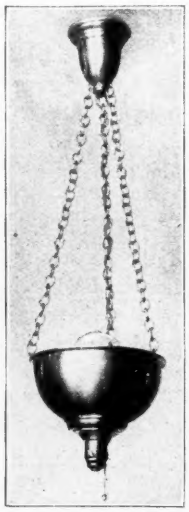
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Indirect Illumination.

At a recent meeting of the Chicago Section of the Illuminating Engineering Society, Augustus D. Curtis read a paper entitled "Indirect Illumination," and described a system of diffused, reflected interior lighting which has been developed but a short time. This system makes commercially available a practical method of indirect illumination, and has been commented upon very favorably, not only by electrical engineers and central-station men, but by optical experts, who view with alarm any increase in intrinsic brilliancy and the present tendency toward over-illumination.



PARLOR FIFTEEN BY FIFTEEN FEET ILLUMINATED BY A ONE-UNIT FIXTURE CONTAINING SIXTY-WATT TUNGSTEN LAMP.



ONE-UNIT CHAIN FIXTURE WITH TUNGSTEN LAMP, TIP UPWARD.

SHOWING HOW THE LIGHTING UNITS CAN BE USED IN MULTIPLES.

This system of lighting affords a light of high candlepower at low cost, and a reflecting surface which gives its first reflection of light toward the ceiling without material loss or absorption. Where gas is used, the necessary candlepower and economy are found in using the higher-grade incandescent-mantle burners. Where electricity is used, the high-efficiency tungsten lamp makes it an ideal source of light for this indirect system of lighting.

The reflecting surface of the reflector surrounding the lamp or mantle offered no difficulties, as this has been marketed for several years under the somewhat misleading name of "X-ray." Reflectors of this type consist of a single piece of blown glass coated on the outer side with pure silver, giving a reflecting surface of high efficiency. The silvering is protected on the outside by coats of elastic enamel.

The correct shape of the inverted reflector for throwing the rays of light to the ceiling without shadows has been the result of considerable calculation and experimentation. The perfected design is of a bell-shape, and contains peculiar circular and vertical corrugations. Being fire-glazed, the exposed glass surface is easily cleaned with a soft cloth.

The bell-shaped corrugated, silvered reflector is fitted in a spun-brass casing. On gas fixtures, this casing rests on the base of the mantle like a globe. With electric fixtures the casing can be either suspended by chains or supported from below. A great variety of ornamental designs can be worked out utilizing these units. Where gas or electric chandeliers are already in use, this system of lighting can be readily adopted. Unless the chandelier arms are very heavy, it can be applied where the sockets are pendent, as the arms do not cast any shadows on the ceiling, because the light comes from so many directions that the effect of shadows is neutralized. These lighting units should be used at or near the center of the room, though side lights can be, and have been, used, with satisfactory results.

Used in Brass Spinning or Casing Shown in Above Illustrations of Lighting Units. SILVER-PLATED REFLECTOR.

A number of installations utilizing this method of lighting have been in use for a some time among professional and business men in their residences and offices. Without exception they are enthusiastic in their praise of the system, and are so impressed with the eye comfort derived that they would not go back to the old system of direct lighting except under protest. These fixtures can be installed in single units or in multiples, either straight electric, straight gas, or combinations of electric and gas. A unit of one reflector and one 100-watt tungsten lamp or a good gas-mantle burner gives a fine illumination in a room up to fifteen feet square. The cost is reasonable, being, on an average, from one-half to one cent per hour.

Pole Seats.

The Peirce Specialty Company, Elkhart, Ind., has developed a number of styles of pole seats to meet all conditions. The braces and frames are made of one-inch by one-half-inch channel steel, and the seat is attached to the pole so that there is no shearing strain on the bolts.

PEIRCE POLE SEAT.

The braces have rugged shoulders on which the frame rests. Five men can safely stand on the cheapest seat made by the Peirce company. It is stated that five men have not only stood but have jumped up and down on this seat. The seats are galvanized and stand the American Telephone and Telegraph Company's test. Galvanized seats are recommended

PEIRCE POLE SEAT, WITH LIVE LOAD OF OVER 850 POUNDS.

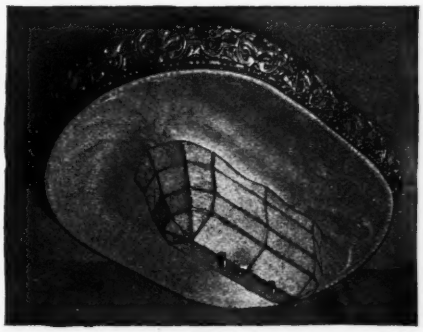
as being cheaper in the long run, and these are shipped ordinarily unless painted seats are preferred.

The accompanying illustrations show the method of attaching the seat. The seat illustrated herewith is thirty-six inches long, and the platform is made of one and one-eighth-inch creosoted cypress, attached to the frame with three countersunk, wax-sealed, galvanized bolts. The other illustration shows the seat standing the test of a live weight of over 800 pounds.

The Extension Diffuser.

The extension diffuser illustrated herewith has been designed to meet the demand for an incandescent fixture embodying the esthetic as well as the scientific principles required for high-grade lighting. It was originally designed by the General Electric Company, Schenectady, N. Y., for use on railway cars, but is especially adapted and recommended for store lighting, and for installation on low ceilings.

As will be noted in the accompanying illustration, the construction of the outfit is remarkably simple; the appearance neat and pleasing. The diffuser can be easily installed on any ceiling where a small flat space can be provided, or it can be sus-



GENERAL ELECTRIC COMPANY'S EXTENSION DIFFUSER.

pended from open-work construction. It is readily adapted for recessing, so that the outer edge is flush with the ceiling line.

The diffuser is held in place by the suspension rods, from which the shade is hung, and the heavy dull finish makes it difficult to distinguish it from plaster. The shade is of white opalescent art glass, strongly bound together, and is specially constructed for rigidity. The glass used in the shade is selected and arranged so as to give maximum diffusion with the minimum absorption of light.

At the present time the extension diffuser is made in two sizes only, the three and six-light; both, however, being adapted for use with tungsten, tantalum or Gem lamps. The larger shades are made in two different styles, known as the deep and the shallow types. The shallow shades are used with lamps of sizes up to and including forty-watt tungsten, forty-watt tantalum, and forty-watt Gem. The deep shades are necessary for use with lamps up to and including 100-watt tungsten, 80-watt tantalum, and 125-watt Gem. Clear-glass lamps only should be used, as the light is thoroughly diffused by the upper and lower shades.

The distribution of light from the extension diffuser is not symmetrical about the vertical axis, as in most lighting units. At angles approaching the horizontal the diffuser emits more light laterally than longitudinally. This is of special advantage in stores when the equipments are installed longitudinally over the center of the aisle. The maximum light being thrown out toward the counters and stock shelves, very little light is thrown directly in the eyes of the customers. The efficiency of the extension diffuser, when compared with other lighting units, is relatively high, especially in consideration of the excellent diffusion.

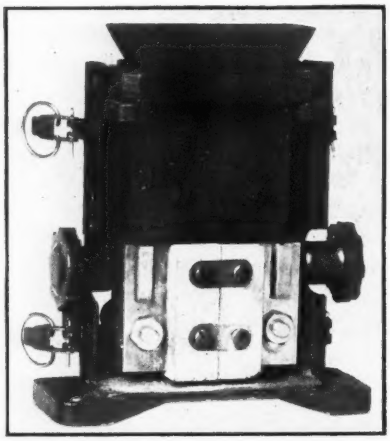
New Orders for General Electric Company.

The General Electric Company reports among recent orders for railway apparatus the following:

The Seattle Electric Company, Seattle, Wash.—Fifty four-motor GE-80 (forty horsepower) car equipments, four 1,000-kilowatt motor-generator sets converting sixty-cycle 13,200-volt current into 600-volt direct current, provided with direct-connected exciters, and four 1,000-kilowatt sixty-cycle 13,200-volt air-blast transformers with blowers, together with the switchboard apparatus. The Denver City Tramway Company, Denver, Colo.—Two 500-kilowatt twenty-five-cycle rotary converters and seven 185-kilowatt oil-cooled transformers. The Sioux City Traction Company, Sioux City, Iowa—Thirty GE-81 (thirty horsepower) railway motors. The Washington Water Power Company, Spokane, Wash.—Twenty four-motor GE-80 car equipments two four-motor GE-73 (seventy-five horsepower) car equipments, with Sprague-General Electric type M control. The Pittsburg Railways Company, Pittsburg, Pa.—One 400-kilowatt engine-driven generator and three 200-kilowatt sixty-cycle rotary converters. The Western New York Construction Company, Buffalo, N. Y.—Eight four-motor GE-204 (seventy-five-horsepower commutating pole) car equipments, with Sprague-General Electric type M control.

Magnetic Blow-Out Fuse Box.

When circuit-breakers were first installed on street cars the motormen regarded them with great favor, and the management has appreciated that they materially reduced the expense for fuses. But gradually the motormen began to find it so easy to throw in the handle of the circuit-breaker that it has become a



MAGNETIC BLOW-OUT FUSE BOX.

very frequent occurrence to overload the motor and trip the breaker. This is not only unnecessary, but is frequently a cause of fright to the passengers. The loud report and the flash frequently cause suit for damages to be brought against the company for real or fancied injuries. This careless handling of the controller does more than merely frighten the passengers, for the excessive flow of current causes heavy strains on the motor windings, which may cause injury to the motor. It is thus seen that it has become too easy a matter for the motorman to reset the protective device on his car.

For such reasons large railway companies are equipping their cars with a simple type of fuse in addition to the standard circuit-breaker. This fuse has been recently developed and placed on the market by the Westinghouse Electric and Manufacturing Company, and is of the magnetic blow-out form, which overcomes the objections to the use of the old fuse box.

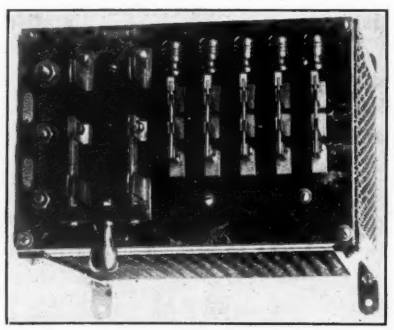
The general design of this fuse box is similar to that of a street-car circuit-breaker, in that it has an all-metal case with the live parts entirely enclosed. It is intended to be placed under the car. The main current is carried by a short copper strip extending down from the terminals in the form of a loop. This loop passes through an arc chute which is supported inside of laminated punchings, thus providing an efficient magnetic blow-out. The blow-out is produced by the ribbon itself without any exterior coils whatever, as a single turn of the ribbon through the iron circuit provides ample magnetism to blow out the arc formed when the ribbon melts. As shown in the illustration, the fuse box is exceedingly compact.

The fuse box will carry 400 amperes continuously without overheating, while the fuses are rated at from 250 to 600 amperes, and are so constructed that they will blow in thirty seconds on 100 per cent overload of this rating. New fuses may be readily inserted by turning the insulating handles on each side of the box without opening the case or using any tools whatever. For the purpose of repairs the sheet-iron front of the box may be readily removed. The arc chute is a single piece and may be readily and cheaply replaced.

This fuse box, while intended primarily for street cars, is not confined to them exclusively, but may be used on industrial motors wherever enclosed fuses would be unsuitable for any reason.

Plating Rheostats for Line Control.

The Ward Leonard Electric Company, Bronxville, N. Y., has designed a complete line of plating rheostats for line control. This is a unique and new design for this apparatus and it offers great possibilities. It is designed for single-voltage and double-voltage control. The accompanying illustration shows a rheostat for line control of the double-voltage

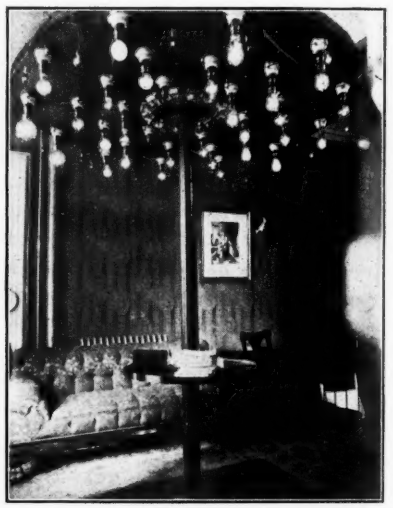


PLATING RHEOSTAT FOR DOUBLE-VOLTAGE LINE CONTROL.

type, to be used on a five and ten-volt circuit either on one leg of a three-wire circuit having five volts on each leg or upon the total ten volts. There is a main-line switch (fused when so desired), which, closed in one direction, gives any current from one to forty amperes on ten volts, and when closed in the opposite direction gives eighty amperes on five volts. This gives thirty-one steps of control on either voltage. Each switch with its resistance is designed to be connected across the full five or ten volts, respectively. The various numbers of steps are obtained by using the switches singly or in parallel. As the resistances are designed for the maximum voltage that can be applied upon them, burn-outs are impossible. These rheostats are designed for any capacities and voltages.

Columbia Incandescent Lamp Display.

The accompanying illustration shows a display of incandescent lamps made by



COLUMBIA LAMP DISPLAY AT CONVENTION OF ASSOCIATION OF CAR-LIGHTING ENGINEERS.

the Columbia Incandescent Lamp Company of St. Louis, Mo., in Parlor K of the Grand Pacific Hotel, Chicago, at the recent convention of the Association of Car-Lighting Engineers. This company was represented at the convention by a large corps of salesmen, a list of whom is given in connection with the report of the closing sessions of the convention, which appears on other pages of this issue.

Want Seattle Subway Franchise.

Etlinger & Company, of London, and Charles A. Debenditty, of Amsterdam, have applied for franchises to construct eight miles of subways in the business and residence district of Seattle, Wash. The plans provide for a system to cost $6,000,000 and to be completed in less than three years.

A 60,000-Volt Direct-Current Transmission System.

The power transmission system which has been recently installed for the city of Lyons, France, is worthy of note not only from the considerable scope of the enterprise, but also from the fact that it differs from the usual methods employed for this class of work. The source of power is a hydraulic plant which is located on the Isère River, lying at a distance of 110 miles from Lyons. Not only is the distance one of the longest which has yet been employed on the Continent for a power line, but the voltage is also one of the highest, this being nearly 60,000 volts. Instead of using the three-phase system for the power line, this latter is operated on the direct-current system according to the method brought out by M. Thury and used in several cases by the Industrie Electrique firm of Geneva, notably in the St. Maurice-Lausanne power transmission plant. Owing to the progress which has been made it is now possible to use a higher voltage for this method than heretofore, but the present standard of 60,000 volts is not the limit, as it is proposed to double this amount when it comes to increasing the station, and this will be done by grounding the line.

To obtain this high voltage with direct-current generators these are coupled in series. A unit of the station consists of a Piccard-Pictet turbine of 1,600 horsepower, to which are coupled four generators upon the same shaft. These four machines in series give 14,400 volts and they are run at 300 revolutions per minute. As the plant now contains four turbine units of this kind, by coupling all the four units in series we obtain 57,600 volts, which is used directly on the power line. Each of the single generators is a six-pole machine of the Thury type and is rated at 270 kilowatts. It furnishes a current of 3,600 volts and seventy-five amperes. On the exterior these machines resemble the usual form of railway generator, and there are two of them mounted on a common foundation plate with two outer bearings. Electric couplings are used between the two pairs of double generators and between the latter and the turbine.

Where the 57,600-volt power line reaches the city there is a first substation located in the suburbs at Vaulx-en-Velin which receives the direct current in a set of motors and delivers three-phase current. This plant has at present three high-voltage direct-current motors of 800 horsepower each, and they are coupled to three-phase alternators. All the direct-current motors are connected in series, while on the three-phase side the alternators are connected in parallel. From this plant the three-phase current is sent by an underground line to a second substation, which is located in the central district of the city. It is designed to produce direct current for the tramway lines, and to this end it has a number of three-phase motors, each coupled to a 600-volt direct-current generator.

Public Utilities Commission Proposed in Illinois.

In the forthcoming session of the Illinois legislature Sam. A. Ettelson, state senator from the third senatorial district, will introduce a bill creating a state commission of seven members, to have comprehensive jurisdiction over all steam and electric railroads, street railways, electric and gas lighting and power companies, telephone and telegraph systems and other public-service corporations. The bill is based largely on the act that Governor Hughes of New York secured the passage of, through the legislature of that state, creating the two public-service commissions that have become so well known.

Only one commission is proposed in Illinois. It is to supersede the present railroad and warehouse commission, but have greatly increased powers in every way. It is to supervise the issues of stocks and bonds by these companies, the regulation of rates and quality of service given the public, and prescribe methods of accounting and reforms of administration and operation. The plan would limit the power of regulation of public utilities now vested in local civic authorities and is therefore approved by many of the public-service corporations that see in it a method of eliminating many petty burdens now imposed on them by municipal councils and other local officials.

On the other hand, Senator Ettelson's proposal has started a lively agitation among the opponents of any curtailment of home rule, and they point out, as an illustration, the excellent results being secured in Chicago as the effect of the traction-settlement ordinances now being carried out under the direction of the board of supervising engineers. As the legislature does not meet till January the agitation of the subject will doubtless bring out many strong arguments for and against the measure.

Improved Facilities for Northwestern Elevated.

The Northwestern Elevated Railroad has completed its terminal at North Water and North Clark streets, Chicago. It has been built over the tracks of the Chicago & Northwestern Railway from Wells to Clark streets and is used about two hours a day during the morning and evening rush to permit a number of trains to be run without entering the Union Loop. It thus not only relieves the congestion on the loop but provides terminal facilities for the road in case of accident to the Wells street bridge or inability to use the loop. Each of the four elevated railways now has a stub terminal of its own near the loop district for auxiliary and emergency service. The new terminal has two tracks with a loading platform between them and two discharge platforms on the outer sides. It was put into service on November 17, practically two weeks before the schedule time of completion and within three months of the breaking of ground. The Brennan Electric Construction Company had the contract for the entire equipment. The Northwestern Elevated Railroad has just put into service a special funeral train, leaving the new terminal at 1 p. m. daily and running direct to Calvary Cemetery.

Monorail Road for New York City.

The first monorail road for the carriage of passengers in the United States is to be built between Bartow station the New York, New Haven & Hartford Railroad and Belden Point, City Island, and will take the place of an old horse-car line. The Public Service Commission has given permission for changing the motive power, and Bion L. Burrows, president of the American Monorail Company, announces that the construction work will begin soon.

Electricity on Southern Pacific.

Advices from California state that the Southern Pacific Company has made application to the authorities in California for permission to convert its present steam operated roads in Berkeley, Cal., and vicinity, for electric transportation.

The Southern Pacific Company has applied for a franchise for that purpose, and the application states that work will be commenced in four months, and completed within two years at a total expenditure of not less than $2,000,000.

Standards of Technical Publicity.

Under this title, Walter B. Snow, publicity engineer, of Boston, Mass., presents an interesting picture of American methods in a recent article in the *American Exporter,* from which the following is quoted:

"In America, above all other countries, publicity is recognized as the handmaid of business success. The fact is fundamental that no sale was ever made in the wide world unless the buyer first learned that the seller had something to sell. No less fundamental is the fact that no legitimate business was ever based upon the ignorance of its customers.

"The high standard of technical publicity which today prevails in America is the result of relatively rapid development; a token, doubtless, of the insatiable energy of its people. It expresses a recognition of the fundamental principle of all advertising—that in the broadest sense it should be considered as an investment and not as an item of expense. The advertiser should not ask, how much does it cost, but how much does it earn?

"America's leadership in publicity has been marked by the educational feature. This is especially true of advertising to and by manufacturers. The country teems with trade journals devoted to the technicalities of particular trades, and to the details of manufacture and sale. In those particularly devoted to engineering, in the widest acceptance of the term, are to be found the best examples of technical advertising. Here the manufacturer, or perchance the engineer, may speak his own language to men who understand its technicalities. What is more, he may be assured that he will find readers. Rare, indeed, is the case where manufacturers or engineers worthy of the name are not subscribers to one or more journals in their particular field. Such subscribers, particularly among the manufacturers, are also advertisers in some of the trade or technical journals which reach the consumers of their products. As a consequence a considerable number of publications in varied lines pass under the eyes of each manufacturer who advertises. From one class of publications he learns what other manufacturers produce that might be helpful to him in the conduct of his office and shop; from others he is able to judge of conditions in the various industries for which his products are destined.

"All this is entirely independent of the vast volume of advertising in the so-called popular magazines, whose name is legion. Here, also, the educational element in construction and wording of the 'ad' is still pronounced. Though it be less technical, the motif of the advertisement is the same; the illustrations are explanatory; they make clear the design or use of the given article; the description is simple and lucid, it tells the reason why.

"Nowhere else are trade papers prepared and published with such care as in America. From the editorial standpoint the leading engineering papers are of exceptionally high order. The presentation of excellent illustrations, both in the reading and advertising columns, is made possible by the use of high-grade paper and careful printing. The half-tone process of reproduction may therefore be employed without fear that the effect of fine engravings will be lost in the printing. Some papers go so far as to request original half-tones for use in the advertising columns.

"The leading papers maintain staffs of advertising writers at the service of their advertisers without charge. In every way they study to encourage the advertiser to exert his best efforts in the presentation of his products. The result is greater frequency of change of copy than occurs in any other class of journals. So good from a technical standpoint is some of this advertising that readers have been led to collect and preserve it for its educational value."

Wireless Experiments with Balloons.

Radio-telegraphic communication with balloons has successfully been maintained in several instances recently, notably by the Condor, which rose from Brussels and exchanged signals with a station erected on the tower of the Palais de Justice, of Brussels. The aeronauts also easily overheard signals sent from the French military station on the Eiffel Tower. The possibility of such signals had long ago been established; danger was, however, feared from the sparks. The first person systematically to experiment in this line, says London *Engineering,* was Hergesell, who, while cruising on the ocean, sent up unmanned balloons from the ship. The balloons were fitted with small receiving apparatus, tuned to different wave lengths on the different balloons, and the arrangement was such that the signal would open the valve of the respective balloon. Hergesell succeeded in bringing certain balloons down again at will at a distance of ten nautical miles.

Mexico to Double Duties on Lamps.

The department of finance of the Mexican Government has submitted to the Congress a bill which revises and increases the import duties on a number of articles. The duty on incandescent electric lamps is increased from eleven cents per kilogramme, gross, to twenty-two cents per kilogramme, gross. Incandescent electric-light globes are now being manufactured in Mexico, and it is understood that the object in doubling the duty is to protect the new home industry. The bill provides that the duty on machinery and apparatus shall continue at $1.65 per 100 kilos, gross, but the following clause, which will be appreciated by importers of machinery, has been inserted:

"The ensemble of pieces constituting a plant of machinery, in whole or in part, may be imported in separate lots, subject to the rate fixed in this schedule, provided that the department of finance so decides in view of the circumstances in each case, and the requirements laid down by the same department be complied with."

Electric-Lighting Equipment for Automobiles.

Among electrical patents issued on November 3 was one granted to Fred. R. Babcock, of Chicago, which covers a lighting equipment for gasoline and steam automobiles. The device is essentially a miniature train-lighting system, much simplified in detail.

From the standpoint of the motorist, the arrangement serves to turn a small portion of the gasoline used in the engine into electricity, which may be used for lights, ignition and any electrical devices desired, and thus limits the supplies required for the car to gasoline and lubricants. The advantages resulting from the elimination of acetylene and kerosene oil, combined with the well-known superiority of electric lights, indicate that this equipment will prove very popular among the automobile fraternity.

Philadelphia Lighting Contract.

The Philadelphia Electric Company was the only concern to submit proposals for the lighting of the city in 1909. Its figures range from twenty-five to twenty-eight cents a light per night, according to location. There are at present 12,000 electric lights throughout the city. The cost of maintenance for 1909 will be $1,182,791.

Current Electrical News

CONTINENTAL EUROPE.

PARIS, NOVEMBER 14.—The new electric tramway line which has been installed in Switzerland to connect the localities of Schwyz and Seewen is noteworthy from the fact that it is operated upon the three-phase system. The electrical outfit of the line is furnished by the Brown-Boveri firm. Should the line be completed according to the present plans it will run from the latter point as far as the town of Brunnen, which lies upon the Four-Cantons lake. Owing to the high gradients which the road possesses, the three-phase system is an advantage here. Current is supplied from a distant turbine plant at 8,000 volts, forty cycles, and a transformer station located near the traction line serves to reduce the voltage to 500, which is used upon the car motors. For the overhead line the road uses a double trolley wire and the car has two trolley poles mounted on the roof. The motor cars are of the tramway type, with the body mounted on a single truck with two axles. The cars each carry thirty-four persons and with the electric outfit weigh about ten tons. The track is of the standard narrow gauge, one metre.

Some of the mining companies, instead of transporting peat, lignite or a poor quality of coal, are now erecting plants for burning this combustible upon the spot and distributing the power in the form of electric energy. A large plant is now in operation in the north of Italy on this principle at San Giovanni-Valdarno in the Tuscany province. It owns rich lignite deposits in this region, but as the lignite contains forty to fifty per cent of water it became difficult to operate the deposits, owing to the cost of transportation compared with the low heating quality of the material. The company decided to erect an electric plant and a power line in order to utilize the product upon the spot and to deliver current over a wide extent of country. The power plant is built near the mines and the combustible is brought by rail to the furnaces. It is first dried partially and is then burned under the boilers. The latter are of special construction so as to consume the half-dried material, and this was found preferable to a previous drying of the lignite, even though the boiler plant had to be built on a larger scale for the purpose. An automatic feed system is used for the furnaces. In the dynamo room are installed the engine and alternator sets, using Westinghouse three-phase alternators of 1,500 kilowatts. These machines are designed for 6,000 volts and fifty cycles, and they are excited by two 130-kilowatt generators. For raising the voltage there are used Oerlikon transformers of the single-phase type, which are connected in groups of three, in order to furnish the three-phase line current at 33,000 volts. The transformers and high-tension switching apparatus are mounted in a series of fireproof cells, which are closed by iron sliding doors. There are at present five high-tension lines starting from the station. One of these lines has about sixteen miles length and reaches Florence. A second line runs further on for a distance of thirty miles to Prato, and a third line runs to Siena at eighteen miles distance.

In order to secure a supply of current for the city of Seville there has lately been erected a power plant which no doubt has the highest voltage yet used on this side of the water for three-phase current. An eighty-foot head of water is obtained from the Guadiaro stream in the Malaga province, with a supply of 4,000 litres per second during eight months of the year. The station building will contain four principal units of 1,500 horsepower each; at present there are three of these units erected. These are three-phase, 5,000-volt alternators working at 410 revolutions per minute and forty cycles. A bank of transformers raises the voltage for the line to 52,000 volts. The power line for this high voltage is of the most modern construction and, like the rest of the plant, is installed by the Oerlikon firm of Zurich. It runs for seventy-five miles through the provinces of Malaga, Cadiz and Seville, and in the region of the Berrueco mountains it reaches an altitude of 2,400 feet above sea level. For the line there are used 1,550 iron-work poles with wood cross-arms. The poles are spaced 240 feet apart on the average, but a maximum distance of 380 feet is often reached. Some of the longer spans reach as high as 1,400 feet. On the poles there are at present two power lines of three wires each using a five-millimetre wire. Along the line there are three substations besides the Seville station. The latter contains the transformer outfit which is needed for the city supply at 3,500 volts. A. DE C.

GREAT BRITAIN.

LONDON, NOVEMBER 12.—A very voluminous report has been issued by the committee on tramway brakes which was appointed about three years ago by the Tramways and Light Railways Association. This committee was the outcome of a series of serious tramway accidents, due to the failure of the brakes to act, and it has received some assistance from the Board of Trade. As testifying to the complete and thorough nature of the investigation which has been carried out it may be mentioned that particulars were obtained of over 5,000 cars, 3,625 being single truck and the remainder double truck. Sixty of the cars were fitted with regenerative control, all had the hand-wheel brake, nearly 3,000 were fitted with the rheostatic brake, about 1,300 with magnetic track brake, 900 with electric short-circuit brake and 120 had a pneumatic track brake. Particulars are given of the very numerous varieties of brake which were investigated and tested by the committee and the causes of accidents are considered in detail. The conclusions of the committee are that all cars should be fitted with two brakes, one of which should be a power brake, although where the traffic is light and the maximum speed slow both may be manually operated. In all accidents, of course, the human element has been an important factor and it is recommended that on all tramway systems there should be a man responsible for the state of the brakes on every car and that a frequent and systematic examination of all brakes should be made. Probably the most useful portion of the report is the section containing particulars of a very large number of tests upon various brakes and sanding apparatus.

Official statistics just published go to show that there are now 216¼ miles of railway in Great Britain worked solely by electricity and 162 miles partly worked electrically. The corresponding figures for a year ago were 197¼ and 157½ miles, respectively. The energy consumed during the past year amounted to 213,675,447 kilowatt-hours, compared with 159,581,401 for the previous year. It is also of interest to note that there are now eighty-six electric locomotives, 806 motor cars and 1,275 trailer cars in use upon these railways.

The manufacturing firm of Bruce, Peebles & Co., which is the agent in this country for Ganz & Co. of Buda Pesth, and which was forced to go into voluntary liquidation last year, has now been reconstructed and a new company is to be formed with a capital of $1,250,000. Creditors and old shareholders are offered stock in the new undertaking upon certain terms which will involve a considerable loss.

Some British and continental capitalists are reported to have joined hands for the purpose of erecting an electric power station in Fiume, Austria, of a capacity of 36,000 horsepower.

It is confidently expected that a result will be arrived at during next week by the committee now considering the bulk electric supply scheme for London. G.

EASTERN CANADA.

OTTAWA, NOVEMBER 21.—From an engineering standpoint, the Ontario hydro-electric power-transmission line from Niagara Falls,

110,000 volts, is the most important of the power-transmission systems of over 40,000 volts in operation and under construction. Work on this system commenced on the 18th inst.

The Montreal fire and light committee has recommended the City Council to offer the Montreal Light, Heat and Power Company a ten-year contract at the following figures: For arc lamps, $75 per lamp per year; for sixty-five-candlepower incandescent lamps, $36, and $24 for thirty-two-candlepower lamps. The proposal also stipulates that the system of lighting now in use shall be replaced by the most modern ones.

The electrification of the Grand Trunk Railway's workshops at Point St. Charles is the latest development of the company's economic policy. The effect of the introduction of electrical equipment in the shops at Stratford and Battle Creek has been to give the management direct practical proof of just what the advantages of electrifying the larger central shops would be. The power required for the purpose of operating the electric plant will be produced from the company's own turbo-generators from coal that it will transport from the mines.

During the coming week there will be several conferences in Montreal between the directors of the Mexican Light and Power Company and representatives of the London house of Sperling & Co. in regard to the leasing of the company to the Mexican Tramways Company. It is now the general belief that the parties favoring the leasing project with the latter company have sufficient proxies to control the actions of the directors, but in view of all the facts, as reported, it is doubtful if the lease, as outlined, will be carried out over the heads of the strong board of directors, who are opposed to the transaction as being unfair to the power company's interests. Should the majority interests, however, undertake to force this lease on the power company the resignation of the directors of that company will likely follow.

One of the best indications of the growing use of electricity is found in the record of the Shawinigan Water and Power Company of Quebec. At present this company is delivering to the city of Montreal 20,000 electric horsepower. As the power was first delivered in 1903, this shows a yearly increase of about 4,000 horsepower, an amount of energy which would, in many cases, operate the entire industries of a city of considerable size. The Shawinigan Company, with its 350 miles of transmission lines reaching from Shawinigan Falls in various directions, is today one of the most complete electrical systems in the world. The power house of this plant is situated about eighty-five miles from Montreal and the company's development is practically completed for 100,000 horsepower. W.

WESTERN CANADA.

WINNIPEG, NOVEMBER 21.—The Manitoba Telephone Commission is now making arrangements with the Saskatchewan government to connect the two government systems at a point a few miles east of Sinclair, Man. At the same time the Alberta government is arranging to make connections with the Saskatchewan system at a point on the boundary between the two provinces. The Kootenay Telephone Company, a newly incorporated concern with a capital of $200,000, announces it will at once commence the construction of long-distance telephone lines through the Crow's Nest Pass and connect with the Alberta system on the boundary line between Alberta and British Columbia. This will give the people of Winnipeg, Man., and Nelson, B. C., and the intervening towns telephonic communication.

According to an announcement made by Hon. Robert Rogers, provincial minister of public works, the rates charged for telephones in Manitoba will be reduced at the beginning of the year. He is also authority for the statement that the profits for the first year of operation of the system under government ownership will amount to $200,000.

Since May last the government of Alberta has added 600 miles of long-distance lines to its provincial telephone system. There are now 1,400 miles of long-distance line under operation by the government and 165 exchanges, against thirty-five in May last. The department of telephones is now planning a number of other lines to be built next year, connecting up the smaller towns and villages in the province.

At Cannington Manor, Saskatchewan, the farmers are organizing for the purpose of building a rural telephone system. Estimates provided by the provincial department of telephones show that a system can be installed at an average cost of $35 per mile, including one telephone per mile. Work will commence shortly.

According to H. N. Ruttan, city engineer, the pumping at the city wells in Winnipeg can be done at a great saving by the use of electricity instead of steam. It is probable arrangements will be made with the Winnipeg Electric Company to furnish the necessary power until such a time as the civic plant at Lac du Bonnet is in operation.

The Dominion Messenger and Signal Company is the name of a new organization in Winnipeg which is applying to the city for the right to receive alarms of all fires by a wire connected with the central fire hall. The company has already secured the privilege of using the conduits of the Manitoba Telephone Commission for its wires. The objects of the company have not yet been disclosed. R.

IMPORTANT DEVELOPMENTS.

ELECTRIFIED OPERATION OF SOUTHERN PACIFIC RAILROAD POSSIBLE—A rumor has been current for some time that the properties of the Great Western Power Company, which were supposed to be allied with the Western Pacific interests, had passed under Harriman control, and that the Southern Pacific's local lines in Alameda County were to be operated by Great Western power, using the plant now under construction at Fruitvale Avenue as an auxiliary. A dispatch from Reno, Nev., declares that the Fleishhackers have secured control of the Truckee River General Electric Company, and that Harriman is behind the Fleishhackers in the deal. The presumption is that the Southern Pacific road from Sparks, Nev., is to be operated by electricity, as it has been hinted a number of times that this would eventually be done. A.

STANISLAUS POWER COMPANY BEGINS OPERATION OF 100,000-VOLT LINE IN CALIFORNIA—Work is progressing rapidly on the new power plant of the Stanislaus Electric Power Company in Tuolumne County, California. The first unit, supplying power in the neighborhood of the plant, was started about a month ago. At present two units, with a capacity of about 13,000 kilowatts, are in operation. The remaining units, which will bring the capacity to 20,000 kilowatts, are now in place, but the final work necessary before they can be started up will take about three weeks more. The transmission line, operating at 100,000 volts, is now in use. Under a temporary arrangement, the power is delivered to the lines of the Pacific Gas and Electric Company at Mission San Jose, which is at present the end of the Stanislaus company's line. It will be several months before the line can be extended into San Francisco, and until that time all the power will be sold to the Pacific company. As soon, however, as the line can be completed, the power will be marketed independently in San Francisco and vicinity. A.

SUIT TO DETERMINE LIABILITY FOR INTERFERENCE OF POWER CIRCUITS WITH TELEPHONE LINES—The case of the Citizens Telephone Company against the Fort Wayne & Springfield Traction Company, filed in the Adams County Circuit Court during the past week, is one of great importance to the electric companies operating in Indiana. Several years ago the commissioners granted a franchise to the telephone company for a right-of-way between Decatur and Fort Wayne. The company put up its poles and wires, which were used successfully for several years. The Fort Wayne & Springfield Traction Company later obtained a right-of-way from the commissioners to run its electric line over the same route, and shortly after the traction line began to operate its high-tension transmission system, it was found that the alternations in the power circuit induced noise in the telephone lines, rendering them useless. The telephone company was compelled to move its lines from two to eight miles from the traction line in order to avoid interference, and for the cost of this the telephone company asks judgment from the interurban company. S.

ELECTRIC LIGHTING.

SLIDELL, LA.—The Slidell Light and Ice Company is to install an electric-light plant.

LINDSAY, OKLA.—The city contemplates issuing bonds to construct an electric-light plant.

MOBRIDGE, S. D.—An electric-light franchise has been granted to E. E. Empey, H. B. Miles and others.

AUSTIN, TEX.—The Board of Regents of the University of Texas contemplates the erection of a power plant.

MAYFIELD, O.—The Mayfield Water & Light Company has increased its capital stock from $10,000 to $20,000.

LITTLE ROCK, ARK.—The Little Rock Railway and Electric Company will expend $75,000 in increasing the capacity of its plant.

MUSCATINE, IOWA.—J. C. Sodini has leased the Electric Park and will convert it into a "White City" amusement park for next year.

GARY, IND.—It is announced that the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa., will establish a branch factory near Gary. S.

SUPERIOR, WIS.—The Northwestern Lighting Company has been incorporated with a capital stock of $15,000 by E. M. Prindle, Theodore Hanson and Louis Hanitch.

NAUVOO, ILL.—The Nauvoo Electric Light and Power Company has incorporated with a capital stock of $5,000. The company consists of local capitalists.

SANTA CRUZ, CAL.—The City Council of Santa Cruz is working on a proposition to issue bonds for the reconstruction of the municipal electric-lighting system.

ANN ARBOR, MICH.—Coach Yost, of the Michigan football team, has had Ferry Field strung with electric lights and an hour of practice is held every evening after dark.

LA CROSSE, WIS.—The La Crosse Water Power Company announces that it will be prepared to generate current for light and power at the plant at Hatfield by December 1.

SONORA, CAL.—The Tuolumne River Power Company has been incorporated at Sonora, with a capital stock of $500,000, by C. D. and W. M. Shaw, C. F. and F. H. Cross.

TWILLINGATE, N. F.—Frederick S. Palmer of Boston, Mass., has obtained a franchise for an electric light and power plant at Twillingate, which he will install this winter.

EVANSVILLE, IND.—Plans are being made by the Evansville Gas and Electric Light Company for improvements costing nearly $400,000. A turbo-generator set will be installed. S.

LAPORTE CITY, IOWA.—The electric light and water plant was damaged by fire to the extent of $3,000 last week. Fire of unknown origin was discovered at 10 o'clock in the morning.

DOWNEY, CAL.—J. R. Gordon has obtained a franchise for furnishing electric light to the town of Downey. He will install a distributing system, covering a territory eight miles square.

LUDINGTON, MICH.—The Interurban Electric Light and Power Company of Ludington has filed articles of incorporation for a capital stock of $100,000 with the secretary of state at Lansing.

HOQUIAM, WASH.—The Grays Harbor Light and Electric Company, of Hoquiam, will shortly install a large amount of new equipment, making material improvements in the lighting service.

COLUMBUS, OHIO—The Middletown Light and Power Company has been incorporated by B. L. Murphy, Charles W. Elliff, Asa McBride and William Sullivan, with a capital stock of $100,000.

HUSUM, WASH.—An electric-light plant to cost about $15,000 will be installed at Stevenson, in Skamania County, deriving power from Rock Creek. The plant is promised to be in running order by December 15.

SPOKANE, WASH.—Jerome Drumheller has organized a company at Spokane with the purpose of developing 10,000 horsepower with a 500-foot head of water, a short distance above the mouth of the Moyie River. Work has already begun on the development. The power will be disposed of for the development of mining and lumbering in northern Idaho. A.

EBANO, MEXICO—The Mexican Petroleum Company will install a hydro-electric plant in its oil field at Ebano, in the state of San Luis Potosi. The company has an extensive industry at that place.

SCOTTSBURG, IND.—The City Council of Scottsburg has decided to install an electric-light and water works plant. As soon as plans are completed, bids for the installation of the plant will be received. S.

GRAND RAPIDS, MICH.—The illumination of Monroe street by series tungsten lamps, a continuation of the lighting scheme of Canal street, was completed, and the current turned on election night, November 3.

CHESTER, VT.—The local electric light company has contracted with the Claremont Electric Power Company for a supply of power developed by harnessing the Black River by the dam at Cavendish Gorge.

WESTPORT, CONN.—The Westport Light and Water Company is laying plans for a line through Green's Farms to Fairfield, and offers to lay out $10,000 on improvements if the Fairfield contract can be secured.

LOS ANGELES, CAL.—The city of Los Angeles, which is engaged in the construction of an aqueduct, will let contracts next month for a 750-kilowatt generator with the necessary equipment and a number of transformers.

DAVENPORT, IOWA.—Brady Street, between Second and Fifth streets, is to have a special illumination scheme, which is supported by a merchants' association. Iron posts surmounted by incandescent lamps will be used.

RED HILL, PA.—If a franchise can be obtained a power plant will be built in Greenville and lines run to Red Hill, furnishing electric light to both towns. East Greenville has had an acetylene gas plant for a year.

GRANDLEDGE, MICH.—Municipal ownership has been found a failure in Grandledge. At a special election the village has voted to sell its electric-lighting plant to the Commonwealth Light and Power Company of Jackson.

RIVER PARK, IND.—The town board of River Park has granted a fifty-year franchise to the Indiana & Michigan Electric Company, to extend its wires, supply street lights and furnish the inhabitants with light and power. S.

GREENVILLE, CAL.—The Round Valley Power Company is installing a plant near Greenville, where a fall of 900 feet is available. It is proposed to generate 2,000 horsepower, which will be sold for irrigation pumping purposes.

REDWOOD CITY, CAL.—The town of Redwood City is planning to extend its electric-lighting service into several residence towns which have recently been built up in the vicinity, and bids will soon be called in for the necessary supplies.

SALT LAKE CITY, UTAH.—The Wasatch Electric Service Company has filed articles. It has 20,000 shares at $1 each. The officers are: Tony Jacobson, president; Sam S. Porter, vice-president; Rob D. McCreery, secretary and treasurer.

LIGONIER, IND.—Municipal ownership of the electric-lighting system of Ligonier is not favored by the citizens. At a recent election the proposition to own and operate a municipal lighting system was voted down by a majority of 72. S.

CHANDLERVILLE, ILL.—The town of Chandlerville has issued its first bonds since its incorporation, to pay for the new municipal lighting plant, recently purchased for $7,000. The installation of the plant is to be completed by December 1.

OROVILLE, CAL.—H. O. Logue has filed several applications for waterpowers in Plumas County and declares that he will build electric power plants. The locations call for 15,000 inches of water on Nelson Creek, a like amount on Onion Valley Creek and 30,000 inches on the Middle Fork of the Feather River at Bidwell Bar, making a total of 60,000 inches. The water from

Nelson and Onion Valley creeks is to be conveyed through Bald Rock Canyon, a wild and rocky canyon that has never been explored by white men.

QUINCY, CAL.—H. O. Lague has been making numerous water locations in Plumas County, California, and it is now announced that he and his associates will build an electric-power plant. Water to the amount of 60,000 inches has been secured.

IOWA CITY, IOWA—The City Council is taking up the matter of electric lights, and maps, proposals, specifications and all other papers, etc., in the matter will be considered carefully by the city solicitor and others, and the Council will be ready for action next month.

OAKLAND, CAL.—A measure has been proposed to the supervisors of Alameda County for the creation of electric-light districts throughout the county similar to the sanitary districts now in existence, in order to relieve the county of the burden of providing lights upon petition.

SAN FRANCISCO, CAL.—The San Francisco Gas and Electric Company will within a few months house its general offices in a handsome new building. Contracts have just been let for the erection of a six-story and basement structure on Sutter street, between Powell and Stockton.

CUERNAVACA, MEXICO.—A large electric-light and power plant is being built in Cuernavaca by E. Conas, the treasurer of the State. The capacity of the new plant will be 1,600 horsepower. It will be used for lighting the city and supplying the tramway system, which is also the property of Mr. Conas.

WHITE SALMON FALLS, WASH.—Martin and J. T. Thompson are installing an electric-lighting plant at White Salmon Falls, to supply the town and the surrounding country. They are installing a 3,000-horsepower engine, and will have all the necessary equipment on the ground in a short time.

VALE, ORE.—The Vale Light and Water Company of Vale, Ore., has been reorganized, R. C. Carter of Baise purchasing a controlling interest in the company. The new president is authority for the statement that the lighting plant will be overhauled and new machinery installed.

LOS ANGELES, CAL.—Work has just been started on a large electrical plant, which will furnish lighting for the Benson Lumber and Logging Company as well as power for the street railway lines of the South Park & East Side Railway. The plant is being erected by the San Diego Wood Products Company, an offspring of the Benson Company.

TACOMA, WASH.—An ordinance is being drawn up by the city attorney of Tacoma for a municipal power project, the principal feature of which is the erection of a $2,000,000 power plant, with a capacity of 20,000 horsepower, on the upper Nisqually River. The plan includes the construction of a reservoir. The initial expense, according to the present plan, is to be met by a $300,000 bond issue. A.

DENVER, COLO.—A bond issue of $1,500,000 has been authorized by the Southern Colorado Power Company for the extension of its electrical transmission lines to all the principal towns in southeastern and southern Colorado and northern New Mexico. Construction work will at once begin along the line of plans already perfected. The central plant of this company is located at Trinidad, Colo., from which light and power will be supplied to all towns within a radius of sixty miles.

INDIANAPOLIS, IND.—J. W. Broady, of Indianapolis, is at the head of a company of manufacturers of central Indiana, who have selected a site for the construction of a power-generating plant in the coal fields near Sullivan, Ind. It is the purpose of these men to erect and equip a plant for the generation of electric power to be transmitted to Indianapolis, Anderson, Crawfordsville, Marion and New Castle. The completion of part of the plant is expected within the next six months. S.

CLEAR LAKE, CAL.—Representatives of the Clear Lake Railway Company, which is working on a projected electric railway line from Napa Valley to the principal towns of Lake County, and the Yolo County Consolidated Water Company are now in San Francisco, and a consolidation of the two concerns is contemplated. Such a deal would enable the railway company, by erecting a low dam at the outlet of Clear Lake, to store ample water to operate a power plant for its line the year round. A.

EL DURO, MEXICO—The Guanajuato Power and Electric Company, which established a large hydro-electric plant at El Duro, state of Michoacan, a few years ago, and built transmission lines to the Guanajuato mining district and city of that name and to other industrial centers within a radius of 150 miles, is making important enlargements and improvements to its great plant and system. It will have its new high-tension transmission line between Guanajuato and Penjamo finished by January 1. The improvements at the various sub-stations of the company will also be completed and ready for operation at that time. New oil switches for the new 60,000-volt line are also being installed. The section of the new reserve transmission line of the company between Guanajuato and Irapuato was recently finished. George W. Bryant, of Colorado Springs, Colo., is an owner.

OBITUARY.

MR. E. H. MIDDLETON, superintendent of the Chicago South Park electric-lighting system, was electrocuted November 22 in the power house at Fifty-eighth Street and Cottage Grove Avenue by coming in contact with a highly charged wire or bus-bar. Mr. Middleton was forty-five years of age, married, and lived at 5328 Jackson Park Avenue.

MR. JAMES FERGUSON, formerly superintendent of the Brooklyn municipal electric-lighting plant and latterly superintendent of the Safety Insulated Wire and Cable Company of Bayonne, N. J., died on November 15 at his home, 173 Hudson Boulevard, Bayonne, of kidney trouble. He was born in Nova Scotia forty-eight years ago and is survived by his widow, a son and two daughters.

MR. OLIVER WELDON BARNES, a civil engineer, who had been identified with railroad construction work in various parts of the United States for the last sixty years, died of pneumonia on November 14 at his home in New York, N. Y., at the age of eighty-eight years. He was engaged in his profession up to a few days before his death. Mr. Barnes was connected with the Pennsylvania Railroad, and it was he who settled the final location of the road from the Alleghany Mountains to Pittsburg, Pa. In 1885 he was a Croton Aqueduct commissioner, and in 1887 was chief engineer of the New York & Long Island Railroad Company. He was a member of the American Society of Civil Engineers, the Union League Club, of New York; the New England Society, and the Engineers' Club, of Philadelphia. He was born at Hartford, Conn., and at sixteen years of age went to Burlington, N. J., to take up his studies as civil engineer, which he completed in Europe. He returned to this country in 1847, and was appointed an engineer in the first corps which went out from Philadelphia to survey the western division of the Pennsylvania Railroad. He was in charge of the engineering for many railroads, including the Boston, Hartford & Erie. In 1871 he became president of the New York City Central Underground Railroad Company, then authorized to build a line from City Hall to Harlem. In 1872 this company passed to the control of the New York & Montreal Railroad Company. Mr. Barnes is survived by a widow, two daughters and a son. He was buried at Fishkill, N. Y., where he had a summer home for forty years.

DATES AHEAD.

International Independent Telephone Association. Annual convention, Chicago, Ill., December 1-3.

American Society of Mechanical Engineers. Annual meeting, New York city, December 1-4.

American Roentgen Ray Society. Annual meeting, New York city, December 28-30.

Chicago Electrical Show. Coliseum, Chicago, Ill., January 16-30, 1909.

American Association for the Advancement of Science. Annual meeting, Baltimore, Md., January, 1909.

Northwestern Electrical Association. Annual meeting, Milwaukee, Wis., January, 1909.

ELECTRIC RAILWAYS.

MISSOULA, MONT.—W. A. Clark is considering the establishment of an electric street-car line at Missoula. C.

DEADWOOD, S. D.—The Black Hills Traction Company expects to have its new electric-generating plant at Deadwood completed by December 1. C.

MARQUETTE, MICH.—The Ironwood and Hurley traction system, which extends from Jessieville through Ironwood and across the Montreal River to Hurley, is to be extended to Bessemer, Mich.

SEATTLE, WASH.—The Seattle-Everett Interurban electric railroad, operating between Seattle and Hall's Lake, has been absorbed by the Stone & Webster interests, and the road will be completed to Everett at once. A.

FRANKFORT, ILL.—The grading for the electric line of the J. & S. Railway along the twelve-mile stretch from Frankfort to Chicago Heights, will soon be completed. Material for the line and track construction is under way.

KALAMAZOO, MICH.—An electric railroad is to be built between Kalamazoo and Elkhart, Ind. This road was surveyed two years ago and much right of way purchased, but it then was dropped for a time. A syndicate has agreed to finance it.

LAWRENCE, KAN.—At a special meeting of the City Council granted a franchise for local service for an electric line to a company headed by W. R. Stubbs, J. E. Stubbs, A. Henley and C. E. Sutton. The company promises to begin work within thirty days.

EVANSVILLE, IND.—On account of the continued drouth it is now costing the Evansville & Southern Indiana Traction Company $800 per month for water to operate its system between Evansville and Princeton. The water is hauled in tanks to the power house in Fort Branch.

EVANSVILLE, IND.—The work of repairing the power house of the Evansville & Eastern Traction Company, at Evansville, has been completed. During the time the power house was out of commission the company operated its road by a locomotive, maintaining a two-hour schedule. S.

WHEELING, W. VA.—Another trolley line has been projected to connect Wheeling with Pittsburg. The new line will follow the West Virginia shore and will be a much shorter route than any that has yet been proposed. The new road will carry passengers over the existing lines from Wheeling to Chester, when the new line will start, with Pittsburg as the terminus.

SACRAMENTO, CAL.—Since the death of Henry A. Butters, president of the Northern Electric Railway Company, parties interested have proposed a combination of the contemplated Hotaling electric line from a point on the bay opposite Sausalito northeasterly to Sacramento, and the Northern Electric, which now extends from Sacramento to Chico, and which soon will be put through to Redding.

PEORIA, ILL.—Two interurban sleeping cars have been operated for eighteen months by the Illinois Traction Company with such success that more cars have been ordered. The first sleepers were put on as experiments, and the chief objection to them proved to be the noise and vibration caused by the motors and the air pump. These interfered with sleep. The new sleepers are made without these noisy accessories, and are run as trailers.

SPOKANE, WASH.—A meeting of stockholders of the Washington Water Power Company has been called for December 1, for the purpose of authorizing a twenty-per-cent increase of the capital stock, which is now $5,016,300, and an issue of bonds to the extent of $15,000,000. It is planned to expend about $2,000,000 a year for the next few years on improvements and extensions. The company now has a number of electric street-railway lines in Spokane, Wash., an interurban railway and an extensive transmission and distributing system, including stations at Spokane, Post Falls and Ross Park. Another important power station is now under construction at Little Falls, on the Spokane River. A.

FAYETTEVILLE, ARK.—Louis Moulton of Boston has applied for a street-car franchise to connect with an electric railway projected from Siloam Springs to Huntsville, Ark. G. T. Propper of Minneapolis also has a plan to build a belt line connecting with a road to Joplin, Mo. The latter contemplates using an old right of way granted for a steam road from Fayetteville east for a distance of six miles.

TOLEDO, OHIO—Curtis M. Steudell and Valentine H. Sorghner, of Chicago, have purchased the Michigan branch of the Toledo, Ann Arbor & Detroit Railway at forced sale, for $60,000. It is generally understood that about $500,000 has already been spent upon the unfinished project, and that it is worth far in excess of the sum paid by the new owners. It is bonded for about a million and a half dollars, and the bondholders will be heavy losers. H.

ELECTRICAL SECURITIES.

For the first time since election the market last week showed some abatement in speculative and investment activity, and public participation fell off, making for bearish conditions. Business, in general, continues to improve, and although there have been exaggerations of the expansion in some quarters, with consequent disappointment, the usual comment is quite satisfactory and optimistic.

Dividends have been declared upon the following electrical securities: General Electric Company; regular quarterly dividend of $2 per share, payable January 15 to stock of record December 3. Kansas City Railway and Light Company; regular quarterly dividend of one and one-fourth per cent on the preferred stock, payable December 1. Norfolk Railway and Light Company; semi-annual dividend of two per cent, payable December 5 to stock of record November 21.

ELECTRICAL SECURITIES FOR THE WEEK ENDED NOVEMBER 21.

New York:	*Closing.*
Allis-Chalmers common	14
Allis-Chalmers preferred	48⅜
Brooklyn Rapid Transit	53¼
Consolidated Gas	151
General Electric	152
Interborough-Metropolitan common	13
Interborough-Metropolitan preferred	33⅜
Kings County Electric	129
Mackay Companies (Postal Telegraph and Cables) common	76
Mackay Companies (Postal Telegraph and Cables) preferred	70
Manhattan Elevated	142½
Metropolitan Street Railway	30
New York & New Jersey Telephone	119
Western Union	65
Westinghouse Mfg. Company	92

Boston:	*Closing.*
American Telephone and Telegraph	130¾
Edison Electric Illuminating	250
Massachusetts Electric	55
New England Telephone	124½
Western Telephone and Telegraph pref	75

Philadelphia:	*Closing.*
Electric Company of America	10¾
Electric Storage Battery common	41½
Electric Storage Battery preferred	41½
Philadelphia Electric	11⅝
Philadelphia Rapid Transit	22½
United Gas Improvement	91

The directors of the Philadelphia Rapid Transit Company have accepted the resignation of George H. Earle, Jr., as a director.

Chicago:	*Closing.*
Chicago Telephone	128½
Commonwealth Edison	108
Metropolitan Elevated preferred	43
National Carbon common	80
National Carbon preferred	112

PERSONAL MENTION.

MR. FRANK N. JEWETT has been appointed general sales manager of the Wagner Electric Manufacturing Company, with headquarters at the main office and factory in St. Louis, Mo.

For the past three years he has been district manager of the Wagner company, with headquarters in the Marquette Building, Chicago. Mr. Jewett was born in New York in 1870, and was graduated from Cornell University in 1893. After his graduation he was employed by B. W. Payne & Sons, of Elmira, N. Y., manufacturing boilers and engines. He spent two years in the experimental department of this company and one year in the sales department. He then became associated with the West Side Street Railway Company, of Elmira, and constructed its power house. Later he was identified with the firm of Evans, Almirall & Company, of New York, contractors for central-station heating and power plants, and in 1900 opened this company's western office in Chicago, retaining the position of western manager until 1906, when he accepted the position of district manager of the Wagner company. Through his connection with the central-station heating industry Mr. Jewett has a large acquaintance in the electrical fraternity and has made a deep impress upon all with whom he has come in contact throughout his entire career. His great knowledge of the requirements of the electrical industry, and his wide acquaintanceship, render him particularly well fitted to direct the sales organization of this important company.

MR. R. H. HARPER has been appointed chief electrician for the Fort Wayne Knitting Mills, Fort Wayne, Ind.

MR. WILLIAM ROBBINS McGOVERN has been appointed chief engineer of the Wisconsin Telephone Company.

MR. H. S. SALT has resigned as vice-president and general manager of the Dale Company, New York city, to take effect on January 1.

MR. W. C. EGBERT has been placed in charge of the Chicago office of the Willard Storage Battery Company, of Cleveland, Ohio.

MR. J. D. EDMONDS, formerly with the Western Electric Company, at Chicago, has been appointed to a responsible position in the operating department of the Sterling Electric Company, Lafayette, Ind.

MR. GEORGE H. FOLDS, for many years an officer of the Twin City Rapid City Transit Company, of Minneapolis, has been appointed general sales manager for the H. W. Johns-Manville Company, of New York. C.

MR. H. W. KENT, formerly superintendent of the British Columbia Telephone Company, has been appointed agent for the province of British Columbia for the Northern Electric Company. His headquarters are at Vancouver, B. C. R.

MR. JOHN H. JENNINGS, who has been superintendent of the Keene Electric Railroad, at Keene, N. H., has tendered his resignation, intending to go to Columbus, Ohio, to take a manager's position with the Ohio Railway Company.

CONGRESSMAN HENRY A. BARNHART, of Rochester, Ind., recently elected from the Thirteenth Indiana District, has taken a prominent part in the Independent telephone movement in Indiana, and was for a time the president of the Rochester Telephone Company.

MR. J. C. GIBSON, who has been division contract agent for the Central Union Telephone Company, with headquarters at Columbus, has taken charge of the Toledo exchange, succeeding F. Lukenbell, who after taking a vacation will accept a position in another part of the Bell territory. H.

MR. WILLIAM J. BAUGHMAN, superintendent of the Stanley-G.-I. Electric Manufacturing Company, Pittsfield, Mass., who has tendered his resignation to take effect December 1, has the selling agency for the General Vehicle Company of Long Island City, N. Y., manufacturers of auto trucks.

MR. HUGH J. McGOWAN, of Indianapolis, is included among those mentioned to succeed Senator Hemenway in the United States Senate. Mr. McGowan is president of the Indianapolis Street Railway Company, and is also president and general manager of the largest system of interurban lines in the state.

DR. CHARLES SIEMANS recently passed through Ottawa, Ontario, on his way from Japan to England. He has been in Japan making an inspection of the railways of that country for the Japanese Government with a view to their electrification. Referring to the proposal to electrify the Canadian Pacific, Dr. Siemens declared that electricity is bound to supplant steam on the railways. He was particularly interested, in his journey across Canada, to notice the profusion of waterpower along the line of the railway.

PROF. J. J. THOMSON has been honored by King Edward of England by conferring knighthood upon him for his extended investigations of the subject of electrons and corpuscles as well as other researches in experimental physics. Sir Joseph John Thomson, as he is to be known from now on, has held the chair of Cavendish professor of experimental physics at Cambridge University since 1884 and that of professor of physics at the Royal Institution since 1905. He is a fellow of the Royal Society and also has the titles D. Soc., LL. D. and Ph. D. He is president-elect of the British Association and will preside at its meeting next year at Winnipeg, Canada.

MESSRS. O. P. FRITCHIE and W. P. PFAFF arrived in Chicago last week and resumed their journey the next afternoon in an electric automobile, in which they are making a run from Lincoln, Neb., to Washington, D. C., and New York city. They desired to make the run from Lincoln to New York in twenty-one days, a distance of more than 1,800 miles. Mr. Fritchie is the manufacturer of the Fritchie electric automobile. Leaving Lincoln on October 31, the Fritchie made an average of seventy miles a day, striking roads in Iowa that were so deep in mud that in one or two places gasoline cars were laid up waiting for the highways to dry. In one stretch eighty-nine miles was covered in a day.

PROPOSALS.

ARC LAMPS, WINNIPEG, MAN.—F. E. Cambridge, city electrician, Winnipeg, Man., has been instructed to advertise at once for tenders for fifty arc lamps for street-lighting purposes. R.

FEDERAL BUILDINGS AT LAKE CHARLES, LA., ALTON, ILL., AND AMERICUS, GA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 26 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the Federal buildings at Lake Charles, La., Alton, Ill., and Americus, Ga., in accordance with specifications, which may be had from the custodians of the respective sites, or at the office of the Supervising Architect.

POSTOFFICES AT NILES AND SAULT STE. MARIE, MICH.—The office of the supervising architect, Washington, D. C., will receive sealed proposals until January 3 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. postoffice at Niles, Mich., and for the construction complete (except elevator) of the postoffice at Sault Ste. Marie, Mich., in accordance with the specifications, which may be had from the respective custodians of site or from the office of the supervising architect.

ENGINEERING SOCIETIES.

ELECTRO TECHNIC CLUB, FORT WAYNE, IND.—The Electro Technic Club, of Fort Wayne, Ind., has announced its programme for 1908-09. A number of prominent men will address the club members on a variety of interesting subjects. The first meeting, held on November 17, was addressed by Prof. C. E. Reed, of the Case School of Applied Science, Cleveland, Ohio, on "Electrical Measuring Instruments." On January 5, E. A. Barnes, superintendent of the Fort Wayne Electric Works, will read a paper on "A Century of Steam."

TELEPHONE AND TELEGRAPH.

SYLVAN, WIS.—The Mill Creek Telephone Company has been incorporated with a capital stock of $3,000.

BEACH, N. D.—The Golden Valley Telephone Company will soon begin installing a telephone system here.

ELLENSBURG, WASH.—The Ellensburg Telephone Company has been incorporated with a capital stock of $10,000.

BOVEY, MINN.—The Mesaba Telephone Company has been granted a franchise for a local exchange at Coleraine and Bovey and will install at once.

COTTONWOOD GROVE, NEB.—The Cottonwood Grove Mutual Telephone Company has been incorporated with a capital of $700 by John Henry and others.

IOWA CITY, IOWA—The Johnson County Telephone Company of this city has reorganized and contemplates the expenditure of about $35,000 in improvements.

ATLANTA, IND.—The Aroma Farmers' Telephone Company, of Atlanta, Hamilton County, has incorporated to build a telephone exchange and system. Henry Carpenter, J. G. Swift and S. E. Billhymer are incorporators.

B. F. Jacobson of Bella Coola, B. C., is making arrangements for the construction of a rural and local telephone system in and around Bella Coola. Construction work will commence as soon as the necessary supplies have been obtained. R.

ROCKWELL CITY, IOWA—P. C. Hoeldoegel of this city, president of the International Independent Telephone Association, has expressed his opinion that the independent telephone companies in the state of Iowa will spend more than $6,000,000 in improvements during the coming year.

FERGUS FALLS, MINN.—The Council of Fergus Falls, Minn., has named a committee to consider the matter of installing a municipal exchange. The Northwestern Telephone Exchange Company had proposed to rebuild the local exchange and raise the rates, and this aroused the idea of a municipal movement.

PERKINSVILLE, IND.—The Farmers' Telephone Company, of Perkinsville, has been organized and will install a local exchange, extending the lines to Frankton, New Lancaster, Elwood and Noblesville. Arrangement has been made with the Central Union Telephone Company for toll-line connection. Charles Harvey, of Elwood, is president of the new company, and F. E. Haworth is secretary.

CINCINNATI, OHIO—The Cincinnati & Suburban Bell Telephone Company has decided to increase its outstanding capital through the issuance of $282,500 treasury stock. The new stock will be given to stockholders at par at the ratio of one share for every twenty-four held. The books close December 14 and the new stock will be allotted on January 4. The present market value of the stock is 175.

EVANSVILLE, IND.—A convention of representatives of the Cumberland Telephone Company and associate companies was held in Evansville November 12. About 100 officials connected with the Cumberland system from southern Illinois, eastern Kentucky and southern Indiana cities were present. J. C. Symmes, superintendent of the Nashville-Evansville district, called the convention to order. During the afternoon session George B. Hall, superintendent of the Evansville-Louisville district presided. After a protracted discussion of a number of questions relating to special features of telephone management and operation the closing address was made by General Manager Leland Hume, who expressed keen appreciation and satisfaction over the attendance and success of the meeting and predicted its results would better the service of the entire system. S.

EDUCATIONAL.

CLARKSON SCHOOL OF TECHNOLOGY—The trustees and faculty of Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., announce the founder's day exercises and twelfth anniversary, on Tuesday evening, December 1, in the assembly hall, at 8 o'clock. The founder's day address will be delivered by Samuel Wesley Stratton, director of the Bureau of Standards, Department of Commerce and Labor, Washington, D. C.

INDUSTRIAL ITEMS.

THE WESTERN ELECTRIC COMPANY, Chicago, will open headquarters in Minneapolis at 114-122 Third Street N. on December 1.

THE UNIVERSAL ELECTRIC STORAGE BATTERY COMPANY, Chicago, announces that its factory and general offices have been merged and that the address of both hereafter will be 65 North Peoria Street, Chicago.

THE JENNEY ELECTRIC MANUFACTURING COMPANY, Indianapolis, Ind., has increased its capital stock from $450,000 to $600,000, and has notified the Secretary of State that the place of business and plant will be removed from Indianapolis to Anderson.

THE WESTERN MACHINE COMPANY, Indianapolis, Ind., has incorporated with a capital stock of $60,000 to establish a plant to manufacture engines, boilers, machinery, tools and electrical and mechanical appliances. George J. Schlotzauer and C. H. Scholl, directors.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., through James J. Wood, announces that since the election $150,000 worth of orders has been booked. The company is increasing its force and facilities gradually, and soon expects to be working beyond its old schedule.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, Chicago, Ill., announces that it has on hand a good supply of electrical toys and novelties for the holiday season. Special catalogues devoted to these specialties will be sent to those interested in this line upon request.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., issued a special bulletin under date of November 16, covering the line of special lamps for train-lighting purposes. This bulletin was prepared especially for the convention of the Association of Car-Lighting Engineers, held in Chicago last week.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces that the Wabash Railroad Company has awarded it a contract for supplying the Fort Wayne, Ind., locomotive repair shops throughout with Wagner polyphase motors. Motors of from ten to forty horsepower capacity constitute this order, and they will be used for driving all kinds of machine tools.

THE MASSACHUSETTS CHEMICAL COMPANY has recently established new quarters for its Boston office at 185 Summer Street, opposite the South Station and across the street from its old location at 170 Summer Street. E. W. Furbush, general manager of the company, usually spends the mornings at the factory at Walpole and the afternoon at the Boston office. Louis O. Duclos, the general sales manager, will make his headquarters at the new offices.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., announces that another large manufacturing plant, the Estey Organ Company, Brattleboro, Vt., is to install electric drive throughout its works. The company has just placed with the Crocker-Wheeler Company an order for fifty-seven induction motors, ranging from one-half to seventy-five horsepower, together with seven transformers and a switchboard. Current will be purchased from the Connecticut River Power Company.

THE SOUTHERN ILLINOIS ELECTRIC COMPANY, East St. Louis, Ill., announces that it has taken over the business of the American vibrator. During the four years this vibrator has been manufactured about 6,000 have been sold. The American vibrator is constructed to produce rotary vibration and has a regulating screw which enables any one of six speeds to be applied. Its efficacy is based upon the principle of producing perfect blood circulation to restore health, in the treatment of nervous diseases, rheumatism, lumbago and numerous other complaints. Since October 1 the Southern Illinois Electric Com-

pany reports that it has sold 260 machines and orders are coming in rapidly from all parts of the world. The company is sanguine of a decided increase in the next few months and these sales, in addition to its electric railway supply, lighting and contracting business, enable it to report prosperous conditions.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY, Minneapolis, Minn., has secured the contract to install a new power plant for the Manhattan City and Interurban Railway Company, of Manhattan, Kan. The installation will include an eighteen by thirty-six inch heavy-duty Twin City Corliss engine, two sixty-six-inch by eighteen-foot horizontal return tubular boilers, one 200-kilowatt generator, together with switchboard, feed-water heater and purifier, boiler-feed pump, etc.

THE BROWN HOISTING MACHINERY COMPANY, Cleveland, Ohio, manufacturer of automatic hoisting and conveying appliances, has issued a new catalogue, which covers thoroughly its well-known products in this line. "Brownhoist" grab buckets for handling coal, ore, limestone, etc., are pictured in use on many different types of machines. The "Brownhoist" single-rope buckets for application to existing machines having but a single-drum engine are also described and illustrated, and automatic dumping tubs, shovel buckets, etc., are shown.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new folder describing Type B knife switches which conform to the National Electrical Code standard. A complete list is given of the current capacities, combinations and prices. Another folder illustrates the use of the Matthews guy anchor, showing the method of placing the anchors in constructing pole lines. An eight-page circular issued by the company describes the construction, application and installation of the new General Electric multi-catch sockets. Several advantages are claimed for these sockets over the older forms.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has prepared a number of little folders and fliers telling about its low-voltage and miniature lamps. One of these that is particularly seasonable describes decorative lighting outfits. The use of these outfits is certain to increase so long as lights are used in connection with Christmas greens, because of the ease with which these outfits can be installed, and, above all, the safety with which they can be used. General Electric outfits are made in sizes containing from eight to thirty-two lamps, and may be connected to any lamp socket by means of the standard attaching plug. Full description and prices are contained in folder No. 3710.

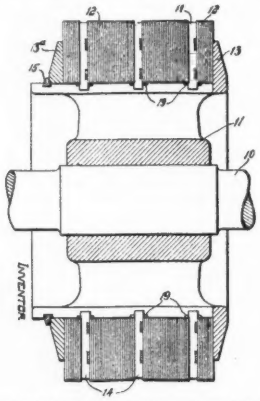
THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has issued catalogue E1, covering Ward Leonard circuit-breakers of single-pole types, in capacities up to and including 150 amperes. Although these single-pole overload circuit-breakers have but one handle they consist of two switches in series, so functionally related that the circuit cannot be held closed when an overload or short-circuit exists. Underload and no-voltage release circuit-breakers are shown for battery and motor protection. The catalogue announces that Ward Leonard circuit-breakers received the gold medal prize at the Paris Exposition, among circuit-breakers from all over the world, and that they received the highest award for exhibit at the Columbian Exhibition.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 17, 1908.

903,826. MANUFACTURE OF METAL-FILAMENT LAMPS. William C. Arsem, Schenectady, N. Y., assignor to General Electric Company. Filed March 16, 1907. The method of protecting a filament from deterioration in the presence of an electric arc consists of locally applying a jet of reducing gas enveloped in a jet of inert gas.

903,829. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed January 31, 1906. Relates to the construction of separators between the sections of a laminated armature core.



903,829.—ARMATURE CORE SEPARATORS.

903,842. EMERGENCY TRAIN-STOPPING DEVICE. Philip Conniff and Franklin A. Pierce, Washington, D. C. Filed January 31, 1908. A circuit closer includes relatively movable contacts and a weighted member carrying the movable contact.

903,860. INCANDESCENT LAMP. John W. Howell, Newark, N. J., assignor to General Electric Company. Filed November 17, 1906. This method of sealing a tungsten filament to a conductor consists in drawing an arc from the end thereof to enclose the filament, the operation being effected within a protective envelope of carbon dioxide and in the presence of illuminating gas.

903,861. ARC LAMP. Charles C. Hughes, Philadelphia, Pa. Filed October 3, 1906. A thermo-expansive alloy member consists of 57½ per cent copper, 42 per cent nickel and one-half of one per cent lead.

903,871. ELECTRIC TELEGRAPHY. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Filed July 8, 1905. A cable telegraph system is provided with means for impressing alternate positive and negative impulses of practically uniform duration upon the cable.

903,875. SYSTEM OF ELECTRICAL INSULATION. Fred M. Locke, Victor, N. Y. Filed March 20, 1907. A modified suspension-type insulator consists of several petticoated insulators connected by supporting ties leading from the bottom section of each insulator to the top section of the one above it.

903,881. COMMUTATOR NECK OR LEAD. Ashley P. Peck, Milwaukee, Wis., assignor to the Bullock Electric Manufacturing Company. Filed November 9, 1905. The lead is composed of a number of strips of sheet metal fastened together, each strip being corrugated lengthwise.

903,892. FLUID-PRESSURE SYSTEM. William F. Schneider, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed April 29, 1907. An electrically controlled air-compressor system.

903,898. AUTOMATIC INDICATOR FOR TELEPHONES. Richard Sedgwick, Richmond, Ind. Filed July 29, 1907. An automatic telephone is provided with a series of figures to indicate the number which a person has called.

903,905. AUTOMATIC RAILROAD GATE. Eugene C. Smith, New York, N. Y., assignor to Lawrence S. Folger, New York, N. Y. Filed May 28, 1906. A motor lowers the gate when the track circuit is closed by the approach of a train.

903,923. METHOD OF AND APPARATUS FOR RELIEVING WIRE CIRCUITS OF ELECTROSTATIC REACTION CURRENTS. Nathaniel G. Warth, Columbus, Ohio. Filed September 16, 1907. A number of composite electromagnetic coils connect the circuit in multiple with the ground at intervals equal to half the maximum length of such a circuit capable of good transmission without a coil applied to it.

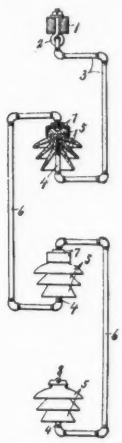
903,927. DRAWBRIDGE CIRCUIT CONTROLLER. Frederick A. Wendler, Elizabeth, N. J., assignor to the Hall Signal Company. Filed May 17, 1907. An electric coupling comprises two separable members adapted to have sliding longitudinal engagement with each other.

903,939. ANODE. Robert J. Wisnom, Virginia City, Nev. Filed May 7, 1907. Consists of a set of rods that can be connected by means of molten metal.

903,945. ELECTROMAGNETIC CLUTCH. Heinrich Ast, Vienna, Austria-Hungary, assignor to Vulkan Maschinenfabriks-Actien Gesellschaft, Vienna, Austria-Hungary. Filed June 15, 1906. One member contains a coil depressed into an iron rim.

903,951. PROCESS FOR THE ELECTROLYSIS OF LIQUIDS. Jean Billiter, Aschersleben, Germany. Filed August 3, 1908. The liquid is fed to the upper one of superposed electrode chambers that are separated by a diaphragm.

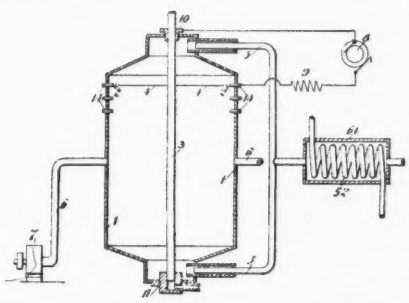
903,966. LAG INDICATOR. William H. Freedman, Burlington, Vt. Filed June 13, 1903. Renewed May 9, 1908. A phase indicator has a circular magnetic core with a polyphase winding thereon in series with the circuit.



903,875.—MODIFIED SUSPENSION-TYPE INSULATOR.

903,972. PIGTAIL BRUSH. Lee C. Hawley, Cleveland, Ohio, assignor to National Carbon Company, Cleveland, Ohio. Filed February 13, 1908. A brush has a transverse hole with a pigtail made of fine wire braided into tubular form, which is distended into intimate contact with its walls.

903,987. CONTACT DEVICE. Frank B. Klopf, New York, N. Y., assignor to Universal Safety Car Controller Company. Filed December 13, 1906. Comprises a casing and a contact member pivotally mounted on a carrier and projecting through an opening in the casing.



904,072.—NITROUS OXIDE PREPARATION.

904,001. ELECTRIC SECONDARY CLOCK. Horace B. McCabe, Chicago, Ill., assignor of one-half to Joseph E. Cochran, Chicago, Ill. Filed November 12, 1906. There are means for transmitting the movement of the magnet armature to a shaft.

904,011. OUTLET BOX. Erwin L. Pierce, Everett, Mass., assignor to Charles S. Knowles, New Bedford, Mass. Filed August 31, 1907. The box has an opening in its wall, an outer stopper partly punched from the body of the box and an inner stopper partly punched from the outer stopper.

904,018. ELECTRICAL SIGNALING SYSTEM. Joseph P. Sauer, Wheaton, Ill. Filed April 10, 1906. In combination with a section of track is a source of current, a controlling relay and an electrically actuated annunciator controlled by the relay.

904,031. TRAPPINGS FOR HORSES. Chelsea L. Warner, Cincinnati, Ohio. Filed June 2, 1906. An incandescent lamp is mounted on a strap. The wires lie between the top and bottom layers thereof.

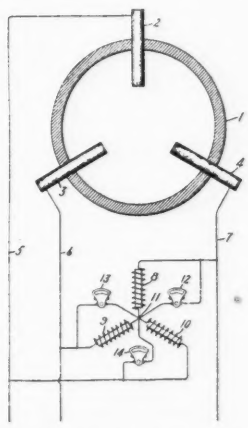
904,042. SWITCH-OPERATING MECHANISM. Robert Brown, Westminster, London, England. Filed July 25, 1906. In a sectional-conduit railway system each car carries a switch-actuating device projecting into the conduit.

904,069. INSULATOR. Willard H. Kempton, Trimble, Ohio. Filed December 16, 1907. The strain insulator has a cylindrical shell formed of longitudinal sections and vitrified insulating blocks extending through the ends of the shell.

904,070. PROCESS FOR EFFECTING CHEMICAL ACTION IN GASES. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to Walter E. F. Bradley, trustee, New York, N. Y. Filed February 18, 1903. The process consists in subjecting the mixture of the gases to the influence of a radio-active body and to the action of an electric arc.

904,071. APPARATUS FOR CHEMICALLY COMBINING GASES. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to Walter E. F. Bradley, trustee, New York, N. Y. Filed February 18, 1903. A combining chamber has electrodes mounted within, means for controlling arcs, means for conducting gases into the influence of the arcs and means for either liquefying or solidifying the gases.

904,072. PROCESS OF CHEMICALLY COMBINING GASES. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to Walter E. F. Bradley, trustee, New York, N. Y. Filed February 18, 1903. A process of promoting the chemical combination of nitrogen and oxygen consists in subjecting the gases to an electric arc and simultaneously refrigerating the nitrous oxides formed.



904,194.—POLYPHASE FURNACE REGULATION.

904,073. APPARATUS FOR EFFECTING CHEMICAL ACTION IN GASES. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to Walter E. F. Bradley, trustee, New York, N. Y. Filed February 18, 1903. Renewed March 23, 1908. This is a modification of numbers 904,070 and 904,072.

904,097. CONNECTOR. Mertie O. Spring, Schenectady, N. Y., assignor to General Electric Company. Filed November 12, 1904. Two terminals are each provided with a clamping face at one end that can be screwed together, the rear ends being protected by an insulating casing.

904,105. TELEPHONE-EXCHANGE SYSTEM AND APPARATUS. Dudley B. Wick, Jr., Cleveland, Ohio, assignor to the North Electric Company, Cleveland, Ohio. Filed September 8, 1904. In combination with the cord circuit is a control-relay having opposite windings governing supervisory signals partially.

904,115. STORAGE BATTERY. Rufus N. Chamberlain, Depew, N. Y., assignor to Gould Storage Battery Company, Depew, N. Y. Filed February 6, 1906. Relates to the construction of the top of a battery jar or tank and a cover therefor.

904,116. RAILWAY BLOCK-SIGNALING SYSTEM. Harry M. Coulter, Chicago, Ill., assignor of one-half to Alfred Stromberg, Chicago, Ill. Filed April 8, 1907. Each block contains a controlling relay in a normally closed track circuit.

904,128. ELECTRIC CLOCK. Robert D. Hickok, Atlanta, Ga. Filed March 27, 1908. In combination with the pendulum rod is an armature frame.

904,139. PROCESS OF MAKING FILAMENTS FOR LIGHTING AND HEATING. Georges Michaud and Eugene Delasson, Paris, France. Filed August 18, 1905. Consists in mixing together alumina and oxides of thorium, cerium and chromium, reducing this to the form of a fine powder, fusing the mixture in a fine stream, and finally forming the fused mas into a filament.

904,157. COMBINED TELEGRAPHIC TRANSMITTER AND TYPEWRITING MACHINE. Augustus G. Snyder, Ilion, N. Y., assignor to Wyckoff, Seamans & Benedict, Ilion, N. Y. Filed April 8, 1904. Includes a series of keys and printing means operated thereby and a series of reciprocatory circuit controllers for transmitting telegraphic signals.

904,185. ARC LAMP. Edward O. Dworak, Chicago, Ill. Filed July 16, 1906. In a regulator for arc lamps there is a pair of supporting tubes with sleeves adapted to slide therein for supporting the carbon rods.

904,194. REGULATION OF POLYPHASE FURNACES. Richard Fleming, Lynn, Mass., assignor to General Electric Company. Filed February 13, 1908. A substantially constant-voltage polyphase source has reactances connected at one end to electrodes and at the other end to a common neutral point and voltmeters connected in parallel with the reactances.

904,196. ELECTRIC IGNITER FOR EXPLOSIVE ENGINES. George A. Goodson, Minneapolis, Minn. Filed February 8, 1902. A magneto generator supplies current for the spark intermittently.

904,203. FUEL HEATER FOR EXPLOSIVE ENGINES. Harry Hertzberg, New York, and Abbot A. Low, Horseshoe, N. Y.; said Hertzberg assignor to said Low. Filed October 10, 1907. There are means for supplying current to a heating member composed of resistance material.

904,222. OSCILLATION-DETECTING MEANS FOR RECEIVING INTELLIGENCE COMMUNICATED BY ELECTRIC WAVES. Greenleaf W. Pickard, Amesbury, Mass. Filed March 11, 1907. Two massive electrical conductors having high thermo-electric power are pressed in contact with each other.

904,248. MEANS FOR REMOVING STATIC ELECTRICITY. William H. Chapman, Portland, Me. Filed February 18, 1907. A strip of non-conducting material has enclosed therein a conductor with portions extending to and terminating flush with the surface of the strip and presenting small points to the air.

904,263. PROCESS OF OBTAINING METALS FROM THEIR ORES. Karl Kaiser, Berlin, Germany. Filed June 22, 1906. Consists of heating raw materials in an electric furnace, then forcing air and finally a gaseous reducing agent into contact with the molten mass until the metals are reduced.

904,280. MAGNETIC SEPARATOR. Marcus Ruthenburg, Lockport, N. Y. Filed June 22, 1907. A vertical rotary shaft carries a magnet comprising opposed annular polar projections.

904,320. SWITCHBOX. Edward J. Dustman, New York, N. Y. Filed April 27, 1907. A wall switchbox has two separable sections arranged so as to allow inclination of one relatively to the other.

904,359. TROLLEY HARP. Joseph Pensis, Speers, Pa. Filed January 31, 1908. One prong of the harp is prolonged beyond the other and extends outwardly to form an arm supporting a trolley-retaining bar.

904,367. RELAY FOR TELEGRAPHS. James Scotland, Hearts Content, Newfoundland. Filed July 10, 1907. The relay has a cylindrical armor for the electromagnet.

904,369. INSULATING BUSHING. Louis Steinberger, New York, N. Y. Filed July 12, 1907. Comprises a number of cylinders, one being provided with a projecting portion which serves as a shed.

904,370. DISK-STRAIN INSULATOR. Louis Steinberger, New York, N. Y. Filed January 20, 1908. A pair of suspension members are separated and partially enveloped by a mass of insulating material provided with flanges extending in opposite directions.

904,415. WATCHMAN'S TIME REGISTER. George W. Ellis, Germantown, Pa. Filed July 3, 1908. An armature in connection with a magnet engages an arm to operate a shutter.

904,420. APPARATUS FOR COOLING ROOMS. Pauline Grayson, New York, N. Y. Filed May 29, 1907. An electric motor operates a circulating fan.

904,425. MEANS FOR AUTOMATICALLY OPERATING GAS OR OTHER VALVES OR ELECTRIC SWITCHES AT PREDETERMINED TIMES. Arnold Hare, Auckland, New Zealand. Filed July 10, 1907. A clock-controlled and spring-actuated time switch.

904,441. COMBINED TELEPHONE-EXCHANGE AND ALARM SYSTEM. John M. Latimer, Philadelphia, Pa., assignor to Consolidated Fire Alarm Company. Filed April 21, 1900. There is a local alarm-transmitting apparatus for establishing grounded connections with the telephone circuit.

904,458. JUNCTION BOX. John N. Scism, Syracuse, N. Y. Filed January 13, 1908. Comprises a shell having a closed bottom and an open top with a plate extending across the opening and removably secured to the shell.

904,462. INTERMITTENTLY DRIVEN MECHANISM ADAPTED FOR CONSTANT DRIVING. Horace H. Taylor, San Jose, Cal., assignor of one-half to Frank J. Mayhew, San Francisco, Cal. Filed July 13, 1907. An electrical circuit-controlling mechanism comprises a chamber and piston, a number of contacts and means actuated by the piston for connecting the contacts.

904,463. CLUTCH. Horace H. Taylor, San Jose, Cal., assignor of one-half to Frank J. Mayhew, San Francisco, Cal. Filed July 13, 1907. Two electromagnets are arranged to oscillate a clutch-moving lever into and out of action.

904,467. ELECTRIC-LIGHTING DEVICE. Clarence Wheeler, Rochester, N. Y., assignor to Metal Specialties Manufacturing Company, Chicago, Ill. Filed September 17, 1907. A hollow handpiece is provided with a metallic socket and a terminal.

904,476. ATTACHMENT FOR INCANDESCENT-LAMP SOCKETS. Henry H. Ham, Shrewsbury, Mass., assignor of one-half to Edwin W. Ham, Worcester, Mass. Filed May 12, 1906. Renewed March 19, 1908. A lamp socket is provided with a switch-operating chain and a movable arm keeping the chain out of contact with the lamp shade.

904,482. INCANDESCENT LAMP. John W. Howell, Newark, N. J., assignor to General Electric Company. Original application filed November 17, 1906. Divided and this application filed October 23, 1907. This is a modification of No. 903,860.

904,486. PROTECTIVE APPARATUS FOR SWITCHBOARDS AND THE LIKE. William Kaisling, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Filed October 5, 1903. A heat coil arrester for a telephone switchboard.

904,491. TROLLEY HEAD AND HARP. Charles E. Marks, Virginia Beach, Va., assignor of one-fourth to Algar M. Wheeler, Norfolk, Va. Filed September 6, 1907. The harp has a pair of guiding wheels at each side of the upper portion of the trolley wheel.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 24, 1908:

463,615. ELECTRIC CONTROLLER FOR ELEVATORS. W. Baxter, Jr., Baltimore, Md.

463,639. ELECTRIC MOTOR MECHANISM. S. E. Mower, New Haven, Conn.

463,671. ARMATURE CORE FOR DYNAMO-ELECTRIC MACHINE. E. Thomson, Lynn, Mass.

463,693. ELECTRIC MOTOR AND GENERATOR. I. E. Storey, Boulder, Colo.

463,704. ELECTRIC MOTOR AND DYNAMO. A. L. Parcelle, Boston, Mass.

463,711. ELECTRIC METER. A. Rechenzaun, London, England.

463,715. CONDUCTOR AND GUIDE FOR ELECTRIC-RAILWAY TROLLEYS. J. I. Conklin, Brooklyn, N. Y.

463,720. ELECTRIC ARC LAMP. W. S. Hays, Troy, Ohio.

463,761. SECTION INSULATOR AND LIGHTNING ARRESTER FOR ELECTRIC RAILROADS. E. Thomson, Swampscott, Mass.

463,762. ELECTRIC ARC INTERRUPTER. E. Thomson, Swampscott, Mass.

463,765. TROLLEY FOR ELECTRIC RAILWAYS. G. H. Alton, Lynn, Mass.

463,766. SWITCH FOR ELECTRIC RAILWAYS. F. O. Blackwell, Boston, Mass.

463,770. ELECTRIC CUT-OUT. E. W. Rice, Jr., Lynn, Mass.

463,793. SYSTEM OF ELECTRIC LIGHTING. E. J. Hodgson and J. W. Stearns, Jr., Denver, Colo.

463,802. ELECTRICAL TRANSMISSION OF POWER. H. W. Leonard, New York, N. Y.

463,808. ELECTRIC SUBWAY SWITCH. L. A. Fehr, New York, N. Y.

463,852. SYNCHRONOUS TELEGRAPH. C. S. Bradley, Yonkers, N. Y.

463,867. AUTOMATIC SAFETY CUT-OUT FOR ELECTRICAL CONDUCTORS. R. A. Morgan, Jr., Boston, and G. C. Bosson, Jr., Lawrence, Mass.

463,879. SEPARATOR FOR THE PLATES OF SECONDARY BATTERIES. C. F. Waldron, Boston, Mass.

463,955. ELECTRIC WIRE INSULATOR. H. F. Newell, Manchester, Va.